

9-1 General

The National Tunnel Inspection Standards (NTIS) are published in the Code of Federal Regulations, 23 CFR 650, Subpart E. The NTIS requires that tunnel owners establish a program for the inspection of highway tunnels, to maintain a tunnel inventory, to report the inspection findings to FHWA, and to correct any critical findings found during these inspections. The Washington State's tunnel inspection program functions fully within the umbrella of the Washington State's bridge inspection organization.

Washington State's tunnel inspection organization is only responsible for state and local agency-owned tunnels. Federally-owned tunnels are inventoried, inspected, and managed by federal agencies. Privately-owned highway tunnels are not included in this requirement, although WSDOT encourages private tunnel owners to inspect and maintain their tunnels in conformance with the NTIS and this manual. There is an open invitation for private tunnel owners to submit tunnel records to the Washington State Bridge Inventory System (WSBIS).

9-1.1 Definitions

Complex Tunnel – A tunnel characterized by advanced or unique structural elements or functional systems.

Highway LID – A structure built with green space which interconnects neighborhoods otherwise cut off or impacted by freeways, with or without local roads. If carrying local roads, the structure must have a deck area at least twice the area of the roads it carries. Highway "LIDS" shall be inventoried as tunnels under the NTIS.

National Tunnel Inspection Standards (NTIS) – Title 23 Code of Federal Regulations 650 Subpart E defines the NTIS regulations, and establishes requirements for inspection procedures, frequency of inspections, qualifications of personnel, inspection reports, and preparation and maintenance of a state tunnel inventory. The NTIS apply to all structures defined as highway tunnels located on all public roads.

Tunnel – The term "tunnel" means an enclosed roadway for motor vehicle traffic with vehicle access limited to portals, regardless of type of structure or method of construction, that requires, based on the owner's determination, special design considerations that may include lighting, ventilation, fire protection systems, and emergency egress capacity. The term "tunnel" does not include bridges or culverts inspected under the National Bridge Inspection Standards (Title 23 Code of Federal Regulations 650 Subpart C). The state of Washington shall prepare and maintain an inventory of all tunnels subject to the NTIS.

Specifications for the National Tunnel Inventory (SNTI) – The SNTI is intended to supplement the NTIS and provide the specifications for coding data required to be submitted to the National Tunnel Inventory (NTI). Data in the NTI will be used to meet legislative reporting requirements and provide tunnel owners, the Federal Highway Administration (FHWA) and the general public with information on the number and condition of the Nation's tunnels.

National Tunnel Inventory (NTI) – The aggregation of structure inventory and appraisal data collected to fulfill the requirements of the National Tunnel Inspection Standards.

Tunnel Operations, Maintenance, Inspection, and Evaluation Manual (TOMIE) – The TOMIE provides uniform and consistent guidance on the operation, maintenance, inspection, and evaluation of tunnels.

See Section 1-1.1 for additional definitions used in this manual.

9-2 Description of Tunnel Inspection Organization

In accordance with the description of the Bridge Inspection Organization offered in Section 1-2, a tunnel inspection organization as required by the NTIS has been developed. The tunnel inspection organization functions completely under the umbrella of the Washington State bridge inspection organization. The makeup of the tunnel organization is identical in all aspects as the bridge inspection organization.

9-3 Tunnel Inspection Programs

In accordance with the description of the Bridge Inspection Programs offered in Section 1-3, a tunnel inspection program as required by the NTIS has been developed. The tunnel inspection program functions completely under the umbrella of the Washington State bridge inspection organization. The makeup of the tunnel inspection program is identical in all aspects as the bridge inspection program.

9-4 Tunnel Inspection Organization Roles and Responsibilities

In accordance with the description of the Bridge Inspection Organization Roles and Responsibilities offered in Section 1-4, tunnel inspection Organization Roles and Responsibilities as required by the NTIS has been developed. Tunnel inspection roles and responsibilities fall completely under the umbrella of the Washington State bridge inspection organization with the additional requirement for the Team Leader as described below.

9-4.1 Team Leader (TL)

A team leader is in charge of an inspection team and responsible for planning, preparing, and performing the field inspection of tunnels. The team leader also makes repair recommendations and is responsible for initiating the critical damage procedures including full tunnel closure if deemed necessary. To qualify as a team leader, the individual must meet, at a minimum, the team leader requirements as described in the NTIS. Team leaders must be recertified on a regular basis by attending a refresher training class according to federal policy. The certification process is described in detail in Section 1-5.

9-5 Tunnel Inspection Certification

Certification for tunnel inspection work within the state of Washington is in accordance with the requirements described in Section 1-5 with the additional requirement of having a Certificate of completion of an FHWA approved comprehensive tunnel inspection course such as the NHI Tunnel Safety Inspection course.

9-6 Tunnel Inspection Certification Probation, Suspension, Decertification and Reinstatement

A process for decertification has been established to ensure that all PM's and TL's are following the proper conduct of their respective positions. The requirements for Tunnel inspectors are identical to that of Bridge Inspectors as described in Section 1-6.

9-7 Inspections

A multi-disciplined approach to tunnel inspection has been adopted by the WSDOT Bridge Preservation Office to comply with the requirements of the NTIS. Routine inspections for the Civil and Structural components are described in Chapter 3 while the Electrical and Mechanical inspection are described in Chapter 8.

9-8 Tunnel Elements

Tunnels elements are listed in Appendix 9-A SNTI condition definitions are consolidated in Appendix 9-A for inspector use, but the guidance therein is intended to be identical in practice to that of the SNTI. In any instance of disagreement in coding definition, SNTI takes precedent.

WSDOT divides inspection responsibility and reporting based on functional systems within the tunnels. For State owned structures, division of labor and reporting is as follows.

Structural Inspectors cover the following element Sections of the SNTI:

- 3.2 – Structural
- 3.3 – Civil
- 3.8 – Protective Systems

Mechanical and Electrical Inspectors are jointly responsible for the following element sections of the SNTI:

- 3.4 – Mechanical Systems
- 3.5 – Electrical and Lighting Systems
- 3.6 – Fire/Life Safety/Security Systems
- 3.7 – Signs

In cases where the tunnel contains no elements from SNTI Sections 3.4-6, and any signs present have no associated mechanical or electrical functionality, any signs present under SNTI Section 3.7-Signs are the responsibility of the Structural Inspectors to inventory and inspect.

9-9 Tunnel QC/QA Program

In accordance with the description of the WSDOT Bridge Preservation Office Quality Control Program offered in Section 7-2, a tunnel QC program as required by the NTIS has been developed. The tunnel inspection program functions completely under the umbrella of the Washington State bridge inspection organization. The makeup of the tunnel QC program is identical in all aspects as the bridge inspection QC program except for Mechanical and Electrical QC, which is developed and documented in Section 8-4.

9-10 Tunnel Records

9-10.1 *SNTI Coding Guide*

In accordance with the description of the WSDOT Bridge Preservation Office Bridge Files and Documentation offered in Section 2-1, Tunnel Files and Documentation as required by the NTIS has been developed. Tunnel Files and Documentation functions completely under the umbrella of the Washington State bridge inspection organization.

The SNTI Coding Guide Section 2 Inventory data has been incorporated into the WSBIS Coding Guide, available in Appendix 2-C. A summary of the SNTI codes with associated WSBIS codes are in Appendix 9-C.

9-11 Appendices

Appendix 9-A	Tunnel BMS Elements
Appendix 9-B	Vacant
Appendix 9-C	WSBIS / NTI Tunnel Inventory Codes

Appendix 9-A Tunnel BMS Elements

Tunnel BMS Element Listing

Element Type	Element Number	Element Description	Unit	Page
Liners	10000	Steel Tunnel Liner	SF	9-A-1
	10001	Cast-In-Place Tunnel Liner	SF	9-A-4
	10002	Precast Concrete Tunnel Liner	SF	9-A-4
	10003	Shotcrete Tunnel Liner	SF	9-A-5
	10004	Timber Tunnel Liner	SF	9-A-5
	10005	Masonry Tunnel Liner	SF	9-A-7
	10006	Unlined Rock Tunnel	SF	9-A-7
	10007	Rock Bolt/Dowel	EA	9-A-7
	10009	Other Tunnel Liner	SF	9-A-8
Tunnel Roof Girders	10010	Steel Tunnel Roof Girders	LF	9-A-8
	10011	Concrete Tunnel Roof Girders	LF	9-A-9
	10012	Prestressed Concrete Tunnel Roof Girders	LF	9-A-9
	10019	Other Tunnel Roof Girders	LF	9-A-10
Columns / Piles	10020	Steel Column / Piles	EA	9-A-10
	10021	Concrete Column / Piles	EA	9-A-11
	10029	Other Column / Piles	EA	9-A-11
Cross Passageway	10030	Steel Cross Passageway	LF	9-A-12
	10031	Concrete Cross Passageway	LF	9-A-13
	10033	Shotcrete Cross Passageway	LF	9-A-13
	10034	Timber Cross Passageway	LF	9-A-14
	10035	Masonry Cross Passageway	LF	9-A-15
	10036	Unlined Rock Cross Passageway	LF	9-A-16
	10039	Other Cross Passageway	LF	9-A-16
Interior Walls	10041	Concrete Interior Walls	SF	9-A-17
	10049	Other Interior Walls	SF	9-A-17
Portals	10051	Concrete Portal	SF	9-A-18
	10055	Masonry Portal	SF	9-A-19
	10059	Other Portal	SF	9-A-19
Ceiling Slab	10061	Concrete Ceiling Slab	SF	9-A-20
	10069	Other Ceiling Slab	SF	9-A-20
Ceiling Girder	10070	Steel Ceiling Girder	LF	9-A-21
	10071	Concrete Ceiling Girder	LF	9-A-21
	10072	Prestressed Concrete Ceiling Girder	LF	9-A-22
	10079	Other Ceiling Girder	LF	9-A-22
Hangers and Anchorages	10080	Steel Hangers and Anchorages	EA	9-A-23
	10089	Other Hangers and Anchorages	EA	9-A-24
Ceiling Panels	10090	Steel Ceiling Panels	SF	9-A-25
	10091	Concrete Ceiling Panels	SF	9-A-25
	10099	Other Ceiling Panels	SF	9-A-26
Invert Slab	10101	Concrete Invert Slab	SF	9-A-27
	10109	Other Invert Slab	SF	9-A-27
Slab-on-Grade	10111	Concrete Slab-on-Grade	SF	9-A-28
	10119	Other Slab-on-Grade	SF	9-A-28

Tunnel BMS Element Listing

Element Type	Element Number	Element Description	Unit	Page
Invert Girder	10120	Steel Invert Girder	LF	9-A-29
	10121	Concrete Invert Girder	LF	9-A-29
	10122	Prestressed Concrete Invert Girder	LF	9-A-30
	10129	Other Invert Girder	LF	9-A-30
Joints	10130	Strip Seal Expansion Joint	LF	9-A-31
	10131	Pourable Joint Seal	LF	9-A-32
	10132	Compression Joint Seal	LF	9-A-33
	10133	Assembly Joint With Seal	LF	9-A-34
	10134	Open Expansion Joint	LF	9-A-34
	10135	Assembly Joint Without Seal	LF	9-A-35
	10139	Other Joint	LF	9-A-35
Gaskets	10140	Gaskets	LF	9-A-36
Wearing Surface	10151	Concrete Wearing Surface	SF	9-A-37
	10158	Asphalt Wearing Surface	SF	9-A-37
	10159	Other Wearing Surface	SF	9-A-38
Traffic Barrier Pedestrian Railing	10160	Steel Traffic Barrier	LF	9-A-38
	10161	Concrete Traffic Barrier	LF	9-A-39
	10169	Other Traffic Barrier	LF	9-A-39
	10170	Steel Pedestrian Railing	LF	9-A-40
	10171	Concrete Pedestrian Railing	LF	9-A-40
	10179	Other Pedestrian Railing	LF	9-A-41
Ventilation System	10200	Ventilation System	EA	9-A-41
	10201	Fans	EA	9-A-42
Drainage and Pumping System	10300	Drainage and Pumping System	EA	9-A-42
	10301	Pumps	EA	9-A-43
Emergency Generator System	10400	Emergency Generator System	EA	9-A-44
Electrical Distribution System	10500	Electrical Distribution System	EA	9-A-45
Emergency Distribution System	10550	Emergency Distribution System	EA	9-A-45
Tunnel Lighting	10601	Tunnel Lighting Fixtures	EA	9-A-46
Emergency Lighting	10620	Emergency Lighting Systems	EA	9-A-47
	10621	Emergency Lighting Fixtures	EA	9-A-47
Fire Detection	10650	Fire Detection System	EA	9-A-48
Fire Protection	10700	Fire Protection System	EA	9-A-48
Emergency Communications	10750	Emergency Communications System	EA	9-A-49
Operations and Security	10800	Tunnel Operations and Security System	EA	9-A-49
Traffic Guidance	10850	Traffic Sign	EA	9-A-50
Egress Signs	10870	Egress Sign	EA	9-A-50

Tunnel BMS Element Listing

Element Type	Element Number	Element Description	Unit	Page
Variable Message Boards	10890	Variable Message Board	EA	9-A-51
Lane Signal	10910	Lane Signal	EA	9-A-51
	10911	Lane Signal Fixture	EA	9-A-52
Protective Systems	10950	Steel Corrosion Protective Coating	SF	9-A-53
	10951	Concrete Corrosion Protective Coating	SF	9-A-53
	10952	Fire Protective Coating	SF	9-A-54
	10955	Reflective Tunnel Tile	SF	9-A-54

Tunnel liner quantities are based on the shape of the liner perimeter which does not include the roadway because the roadway/slab elements document these conditions. The total quantity for circular tunnel shape has a circular perimeter multiplied by the length of tunnel. The total quantity for a horseshoe tunnel is the perimeter exposed to traffic minus the roadway surface multiplied by the length of tunnel.

10000	Steel Tunnel Liner	Units - SF
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Record this element for all steel tunnel liners. Steel tunnel liners function as a shell for the exterior of the tunnel and as a divider between different bores of the tunnel.

The area of a tunnel liner is the product of the length (along the centerline) of the tunnel and the perimeter of the liner.

1. Defects are superficial and have no effect on the structural capacity of the tunnel.
2. Tunnel Liner area corrosion of steel has initiated and there may be areas of freckled rust. Cracking that has self-arrested or has been arrested with effective arrest holes, doubling plates, or similar may exist in the liner. Connections have loose fasteners or pack rust without distortion, but the connections are in place and functioning as intended. Distortion in the liner is present and has received a structural review and has been mitigated. Liner surfaces are saturated indicating seepage may be present or evidence of past seepage.
3. Tunnel Liner area with structural defects that do not require a structural review or may require a structural review but does not require mitigation. Areas of corrosion may exist where section loss is evident, or pack rust is present. Cracks may exist and have not been arrested. Connections may have missing bolts, rivets, or fasteners; broken welds; or pack rust with distortion. Liner surfaces may have areas that are fully saturated with seepage.
4. Tunnel liner area condition warrants a structural review to determine the effect of strength or serviceability of the liner, OR a structural review has been completed and the defects impact strength and serviceability of the liner. Liner surfaces may have areas with seepage that ranges from dripping to flowing.

10001	Cast-in-Place Concrete Tunnel Liner	Units - SF
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Record this element for all cast-in-place concrete tunnel liners. Cast-in place concrete tunnel liners function as a shell for the exterior of the tunnel and as a divider between different bores of the tunnel.

The area of a tunnel liner is the product of the length (along the centerline) of the tunnel and the perimeter of the liner.

1. Defects are superficial and have no effect on the structural capacity of the tunnel liner. Cracking may exist with widths less than 0.012 in. or spacing greater than 5.0 ft.
2. Tunnel Liner area delamination's, spalls 1 in. or less deep or 6 in. or less diameter, and/or patched areas that are sound. Areas of exposed rebar may be present but without measurable section loss. Efflorescence may include white surfaces without build-up or leaching without rust staining. Cracking may exist with widths 0.012 - 0.10 in. or spacing between 1.0 - 5.0 ft. Distortion of liner has received structural review and has been mitigated. Liner surfaces are saturated indicating seepage may be present or evidence of past seepage.
3. Tunnel Liner area with structural defects that do not require a structural review or may require a structural review but does not require mitigation. Spalls greater than 1.0 in. deep or greater than 6 in. diameter may exist, patched areas are unsound or showing distress. Areas of exposed rebar are present with measurable section loss. Areas of efflorescence may exist with heavy build-up and rust staining. Cracking may exist with widths greater than 0.10 in. below the spring line or greater than 0.012 in. above the spring line or spacing less than 1.0 ft. Liner surfaces may have areas that are fully saturated with seepage.
4. Tunnel Liner area condition warrants a structural review to determine the effect of strength or serviceability of the liner, OR a structural review has been completed and the defects impact strength and serviceability of the liner. Liner surfaces may have areas with seepage that ranges from dripping to flowing.

10002	Precast Concrete Tunnel Liner	Units - SF
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Record this element for all precast concrete tunnel liners. Precast concrete tunnel liners function as a shell for the exterior of the tunnel and as a divider between different bores of the tunnel.

The area of a tunnel liner is the product of the length (along the centerline) of the tunnel and the perimeter of the liner.

See Cast-in-Place Concrete Tunnel Liner (10001) for condition state specifications.

10003	Shotcrete Tunnel Liner	Units - SF
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Record this element for all shotcrete tunnel liners. Shotcrete tunnel liners function as a shell for the exterior of the tunnel and as a divider between different bores of the tunnel.

The area of a tunnel liner is the product of the length (along the centerline) of the tunnel and the perimeter of the liner.

See Cast-in-Place Concrete Tunnel Liner (10001) for condition state specifications.

10004	Timber Tunnel Liner	Units - SF
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Record this element for all timber tunnel liners consisting of timber sets with or without timber lagging. Timber tunnel liners function as a shell for the exterior of the tunnel and as a divider between different bores of the tunnel.

The area of a tunnel liner is the product of the length (along the centerline) of the tunnel and the perimeter of the liner.

1. Defects are superficial and have no effect on the structural capacity of the tunnel.
2. Tunnel Liner area with decay that has started in the timber sets or lagging, no fungus growth or discoloration is present. Small voids may exist in the annular space behind the lagging. Cracks, splits, or checks may exist in the timber sets or lagging. Distortion or misalignment between timber members may exist but is 0.125 in. or less. Insect infestation has started in the timber sets or lagging. Connections have loose bolts, or fasteners are present, but the connections are in place and functioning as intended. Timber surfaces are saturated indicating seepage may be present or evidence of past seepage.
3. Tunnel Liner area with structural defects. Decay has resulted in loss of strength, deflection, or crushing of the element but not of a sufficient magnitude to affect the strength and serviceability of the tunnel. Fungus growth and discoloration is present. Large voids may exist in the annular space behind the lagging. Cracks, splits or checks exist in the timber sets or lagging and has impacted strength and/or serviceability but does not warrant a structural review. Distortion or misalignment between timber members may exist and is between 0.125 in. and 0.25 in. Insect infestation exists in the timber sets or lagging and has produced loss of strength or deflection of the element but not of a sufficient magnitude to affect the strength and/or serviceability of the tunnel. Connections have missing bolts or fasteners but does not require a structural review. Timber surfaces are fully saturated with seepage.
4. Tunnel liner area condition warrants a structural review to determine the effect of strength or serviceability of the liner, OR a structural review has been completed and the defects impact strength and serviceability of the liner. Liner surfaces may have areas with seepage that ranges from dripping to flowing.

10005	Masonry Tunnel Liner	Units - SF
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Record this element for all masonry tunnel liners. Masonry tunnel liners function as a shell for the exterior of the tunnel and as a divider between different bores of the tunnel.

The area of a tunnel liner is the product of the length (along the centerline) of the tunnel and the perimeter of the liner.

1. Defects are superficial and have no effect on the structural capacity of the tunnel. Surface is dry.
2. Tunnel liner area with cracking or voids in less than 10% of joints. Efflorescence may include white surfaces without build-up or leaching without rust staining. Block or stone has split or spalled with no shifting and all patching is sound. Block or stone has only shifted slightly out of alignment. Distortion has received structural review and has been mitigated. Saturated surface indicating seepage may be present or evidence of past seepage.
3. Tunnel liner areas of efflorescence may exist with heavy build-up and rust staining. There is cracking or voids in 10% or more of the joints. Block and stone have split or spalled with shifting but does not warrant a structural review or patching is unsound. Block or stone has shifted significantly out of alignment or is missing but does not warrant structural review. Distortion has received structural review and does not require mitigation. Surface is fully saturated with seepage.
4. Tunnel liner area condition warrants a structural review to determine the effect of strength or serviceability of the liner, OR a structural review has been completed and the defects impact strength and serviceability of the liner. Liner surfaces may have areas with seepage that ranges from dripping to flowing.

10006	Unlined Rock Tunnel	Units – SF
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Record this element for all unlined rock tunnels. Unlined rock tunnels function as the exterior of the tunnel and as a divider between different bores of the tunnel.

The area of an unlined rock tunnel is the product of the length of the tunnel (along the centerline) and the perimeter of the unlined rock.

1. Tunnel has no drummy rock, blocks, or slabs apparent, and no shear zones are in evidence. There are no displacements visible along joints and cracks, and the surface is dry.
2. Tunnel has rockfall with any blocks or slabs that are tightly interlocked with the surrounding rock and are not in danger of separating from the parent rock mass. Any displacements along shear zones, joints, or cracks appear to be old, i.e., to have come about prior to the existence of the tunnel. The drummy areas are less than or equal to 1.0 ft. in diameter. All patches are sound. Saturated surface indicating seepage may be present or evidence of past seepage.
3. Tunnel has rockfall with any blocks or slabs that are not tightly interlocked with the surrounding rock that are less than 1 ft. in diameter. Displacements along shear zones, joints, or cracks have occurred since construction. The drummy areas are greater than 1.0 ft in diameter. Patches are unsound. Surface is fully saturated with seepage.
4. Tunnel condition warrants a structural review to determine the effect of strength or serviceability of the element or tunnel, OR a structural review has been completed and the defects impact strength and serviceability of the element or tunnel. Tunnel may have areas with seepage that ranges from dripping to flowing.

10007	Rock Bolt/Dowel	Units – EA
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Record this element for all rock bolts or dowels and is not a tunnel liner element. This documents all rock or soil nails used to stabilize the earth in the tunnel, or at and above the portals. Dowels used to connect pieces of precast concrete tunnel liner are considered part of the tunnel liner element and not included in this element.

The total number of rock bolt/dowels is the sum of all the number of rock bolts and dowels.

1. Defects are superficial and have no effect on the structural capacity of the tunnel.
2. There are loose or missing nuts, but the bolt/dowel is in alignment and functioning as intended. There is deformation or cracking of liner or supported rock.
3. There are loose or missing nuts; the bolt/dowel is out of alignment or loose. There is deformation or crackling and spalling of liner or supported rock.
4. The condition warrants a structural review to determine the effect on strength or serviceability of the element or tunnel, OR a structural review has been completed and the defects impact strength and serviceability of the element or tunnel.

10009	Other Tunnel Liner	Units – SF
<p>Record this element for all tunnel liners composed of other materials. Other tunnel liners function as a shell for the exterior of the tunnel and as a divider between different bores of the tunnel.</p>		
<p>The area of a tunnel liner is the product of the length (along the centerline) of the tunnel and the perimeter of the liner.</p>		
<ol style="list-style-type: none"> 1. Defects are superficial and have no effect on the structural capacity of the tunnel. There are cracks are present but they have not allowed the rock to shift. 2. Tunnel liners may have cracks present and rock has minor shifting. Distortion has received structural review and has been mitigated, and all patches are sound. Saturated surface indicating seepage may be present or evidence of past seepage. 3. Tunnel liner may have rocks that are cracked with face deformation. There are rocks missing. Distortion has received structural review and does not require mitigation. Unsound patches. Surface is fully saturated with seepage. 4. Tunnel liner area condition warrants a structural review to determine the effect of strength or serviceability of the liner, OR a structural review has been completed and the defects impact strength and serviceability of the element or tunnel. Liner surfaces may have areas with seepage that ranges from dripping to flowing. 		
10010	Steel Tunnel Roof Girders	Units – LF
<p>Record this element for all steel tunnel roof girders. Tunnel roof girders support the tunnel roof liner or exposed rock which constitutes the tunnel roof.</p>		
<p>The total length of tunnel roof girder is the sum of all the lengths of each tunnel roof girder.</p>		
<ol style="list-style-type: none"> 1. Defects are superficial and have no effect on the structural capacity of the tunnel. 2. Roof Girder length where corrosion of steel has initiated and there may be areas of freckled rust. Cracking that has self-arrested or has been arrested with effective arrest holes, doubling plates, or similar may exist in the element or tunnel. Connections have loose fasteners or pack rust without distortion, but the connections are in place and functioning as intended. Distortion is present and has received a structural review and has been mitigated. Surfaces are saturated indicating seepage may be present or evidence of past seepage. 3. Roof Girder length with structural defects that do not require a structural review or may require a structural review but does not require mitigation. Areas of corrosion may exist along the length of the girder where section loss is evident, or pack rust is present. Cracks may exist and have not been arrested. Connections may have missing bolts, rivets, or fasteners; broken welds; or pack rust with distortion. Surfaces may have areas that are fully saturated with seepage. 4. Roof Girder condition warrants a structural review to determine the effect of strength or serviceability of the element or tunnel, OR a structural review has been completed and the defects impact strength and serviceability of the element or tunnel. Surfaces may have areas with seepage that ranges from dripping to flowing. 		

10011	Concrete Tunnel Roof Girders	Units - LF
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Record this element for all concrete tunnel roof girders. Tunnel roof girders support the tunnel roof liner or exposed rock which constitutes the tunnel roof.

The total length of tunnel roof girder is the sum of all the lengths of each tunnel roof girder.

1. Defects are superficial and have no effect on the structural capacity of the tunnel. Cracking may exist with widths less than 0.012 in. or spacing greater than 3.0 ft.
2. Roof Girder length with delamination's, spalls 1 in. or less deep or 6 in. or less diameter, and/or patched areas that are sound. Areas of exposed rebar may be present but without measurable section loss. Efflorescence may include white surfaces without build-up or leaching without rust staining. Cracking may exist with widths 0.012 - 0.05 in. or spacing between 1.0 - 3.0 ft.
3. Roof Girder length with structural defects that do not require a structural review or may require a structural review but does not require mitigation. Spalls greater than 1.0 in. deep or greater than 6 in. diameter may exist, patched areas are unsound or showing distress. Areas of exposed rebar are present with measurable section loss. Areas of efflorescence may exist with heavy build-up and rust staining. Cracking may exist with widths greater than 0.05 in. or spacing less than 1.0 ft.
4. Roof Girder condition warrants a structural review to determine the effect of strength or serviceability of the element or tunnel, OR a structural review has been completed and the defects impact strength and serviceability of the element or tunnel.

10012	Prestressed Concrete Tunnel Roof Girders	Units - LF
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Record this element for all prestressed concrete tunnel roof girders. Tunnel roof girders support the tunnel roof liner or exposed rock which constitutes the tunnel roof.

The total length of tunnel roof girder is the sum of all the lengths of each tunnel roof girder.

1. Defects are superficial and have no effect on the structural capacity of the tunnel. Cracking may exist with widths less than 0.004 in. or spacing greater than 3.0 ft.
2. Roof Girder length with delamination's, spalls 1 in. or less deep or 6 in. or less diameter, and/or patched areas that are sound. Areas of exposed rebar may be present but without measurable section loss. Efflorescence may include white surfaces without build-up or leaching without rust staining. Cracking may exist with widths 0.004 - 0.009 in. or spacing between 1.0 - 3.0 ft. Exposed prestressing is present without section loss.
3. Roof Girder length with structural defects that do not require a structural review or may require a structural review but does not require mitigation. Spalls greater than 1.0 in. deep or greater than 6 in. diameter may exist, patched areas are unsound or showing distress. Areas of exposed rebar are present with measurable section loss. Areas of efflorescence may exist with heavy build-up and rust staining. Cracking may exist with widths greater than 0.009 in. or spacing less than 1.0 ft. Exposed prestressing is present with section loss but does not warrant a structural review.
4. Roof Girder condition warrants a structural review to determine the effect of strength or serviceability of the element or tunnel, OR a structural review has been completed and the defects impact strength and serviceability of the element or tunnel.

10019	Other Tunnel Roof Girders	Units - LF
Record this element for all tunnel roof girders composed of other materials. Tunnel roof girders support the tunnel roof liner or exposed rock which constitutes the tunnel roof.		
The total length of tunnel roof girder is the sum of all the lengths of each tunnel roof girder.		
<ol style="list-style-type: none"> 1. Defects are superficial and have no effect on the structural capacity of the tunnel. Roof Girders are in good condition with no notable distress. 2. Roof Girder lengths are in fair condition with isolated breakdowns or deterioration. 3. Roof Girder lengths are in poor condition with widespread deterioration or breakdowns without reducing load capacity 4. Roof Girder condition warrants a structural review to determine the effect of strength or serviceability of the element or tunnel, OR a structural review has been completed and the defects impact strength and serviceability of the element or tunnel. 		

Tunnel Column/Piles

10020	Steel Columns/Piles	Units - EA
Record this element for all steel columns/piles. Tunnel columns support the tunnel roof girders, tunnel ceiling girders and/or tunnel invert girders. Tunnel piles provide support for the tunnel columns.		
The total number of columns/piles is the sum of all the number of columns and piles.		
<ol style="list-style-type: none"> 1. Defects are superficial and have no effect on the structural capacity of the tunnel. The connection is in place and is functioning as intended. 2. Column/Pile area where corrosion of steel has initiated and there may be areas of freckled rust. Cracking that has self-arrested or has been arrested with effective arrest holes, doubling plates, or similar may exist in the columns/piles. Connections have loose fasteners or pack rust without distortion, but the connections are in place and functioning as intended. Distortion in the columns/piles is present and has received a structural review and has been mitigated. 3. Column/Pile area with structural defects that do not require a structural review or may require a structural review but does not require mitigation. Areas of corrosion may exist where section loss is evident, or pack rust is present. Cracks may exist and have not been arrested. Connections may have missing bolts, rivets, or fasteners; broken welds; or pack rust with distortion. 4. Column/Pile area condition warrants a structural review to determine the effect of strength or serviceability of the element or tunnel, OR a structural review has been completed and the defects impact strength and serviceability of the element or tunnel. 		

10021	Concrete Columns/Piles	Units - EA
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Record this element for all concrete columns/piles. Tunnel columns support the tunnel roof girders, tunnel ceiling girders and/or tunnel invert girders. Tunnel piles provide support for the tunnel columns.

The total number of columns/piles is the sum of all the number of columns and piles.

1. Defects are superficial and have no effect on the structural capacity of the tunnel. Cracking may exist with widths less than 0.012 in. or spacing greater than 3.0 ft.
2. Column/Pile area with delamination's, spalls 1 in. or less deep or 6 in. or less diameter, and/or patched areas that are sound. Areas of exposed rebar may be present but without measurable section loss. Efflorescence may include white surfaces without build-up or leaching without rust staining. Cracking may exist with widths 0.012 - 0.05 in. or spacing between 1.0 - 3.0 ft.
3. Column/Pile area with structural defects that do not require a structural review or may require a structural review but does not require mitigation. Spalls greater than 1.0 in. deep or greater than 6 in. diameter may exist, patched areas are unsound or showing distress. Areas of exposed rebar are present with measurable section loss. Areas of efflorescence may exist with heavy build-up and rust staining. Cracking may exist with widths greater than 0.05 in. or spacing less than 1.0 ft.
4. Column/Pile area condition warrants a structural review to determine the effect of strength or serviceability of the element or tunnel, OR a structural review has been completed and the defects impact strength and serviceability of the element or tunnel.

10029	Other Columns/Piles	Units - EA
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Record this element for all columns/piles composed of other materials. Tunnel columns support the tunnel roof girders, tunnel ceiling girders and/or tunnel invert girders. Tunnel piles provide support for the tunnel columns.

The total number of columns/piles is the sum of all the number of columns and piles.

1. Column/Pile is in good condition with no notable distress.
2. Column/Pile is in fair condition with isolated breakdowns or deterioration.
3. Column/Pile is in poor condition with widespread deterioration or breakdowns without reducing load capacity.
4. Column/Pile condition warrants a structural review to determine the effect of strength or serviceability of the element or tunnel, OR a structural review has been completed and the defects impact strength and serviceability of the element or tunnel.

Tunnel Passageway

10030	Steel Cross Passageway	Units - LF
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Record this element for all steel cross passageways. Cross passageways are typically oriented transverse to the tunnel bores and are comprised of doors to allow egress between separated tunnel bores.

The total length of cross passageways is the sum of all the lengths of each cross passageway.

1. Defects are superficial and have no effect on the structural capacity of the tunnel. Connection is in place and functioning as intended.
2. Cross Passageway length where corrosion of steel has initiated and there may be areas of freckled rust. Cracking that has self-arrested or has been arrested with effective arrest holes, doubling plates, or similar may exist in the element or tunnel. Connections have loose fasteners or pack rust without distortion, but the connections are in place and functioning as intended. Distortion is present and has received a structural review and has been mitigated. Surfaces are saturated indicating seepage may be present or evidence of past seepage.
3. Cross Passageway length with structural defects that do not require a structural review or may require a structural review but does not require mitigation. Areas of corrosion may exist where section loss is evident, or pack rust is present. Cracks may exist and have not been arrested. Connections may have missing bolts, rivets, or fasteners; broken welds; or pack rust with distortion. Surfaces may have areas that are fully saturated with seepage.
4. Cross Passageway condition warrants a structural review to determine the effect of strength or serviceability of the element or tunnel, OR a structural review has been completed and the defects impact strength and serviceability of the element or tunnel. Surfaces may have areas with seepage that ranges from dripping to flowing.

10031	Concrete Cross Passageway	Units - LF
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Record this element for all concrete cross passageways. Cross passageways are typically oriented transverse to the tunnel bores and are comprised of doors to allow egress between separated tunnel bores.

The total length of cross passageways is the sum of all the lengths of each cross passageway.

1. Defects are superficial and have no effect on the structural capacity of the tunnel liner. Cracking may exist with widths less than 0.012 in. or spacing greater than 5.0 ft.
2. Cross Passageway length with delamination's, spalls 1 in. or less deep or 6 in. or less diameter, and/or patched areas that are sound. Areas of exposed rebar may be present but without measurable section loss. Efflorescence may include white surfaces without build-up or leaching without rust staining. Cracking may exist with widths 0.012 - 0.10 in. or spacing between 1.0 - 5.0 ft. Distortion of passageway has received structural review and has been mitigated. Surfaces are saturated indicating seepage may be present or evidence of past seepage.
3. Cross Passageway length with structural defects that do not require a structural review or may require a structural review but does not require mitigation. Spalls greater than 1.0 in. deep or greater than 6 in. diameter may exist, patched areas are unsound or showing distress. Areas of exposed rebar are present with measurable section loss. Areas of efflorescence may exist with heavy build-up and rust staining. Cracking may exist with widths greater than 0.10 in. below the spring line or greater than 0.012 in. above the spring line or spacing less than 1.0 ft. Surfaces may have areas that are fully saturated with seepage.
4. Cross Passageway condition warrants a structural review to determine the effect of strength or serviceability of the element or tunnel, OR a structural review has been completed and the defects impact strength and serviceability of the element or tunnel. Surfaces may have areas with seepage that ranges from dripping to flowing.

10033	Shotcrete Cross Passageway	Units - LF
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Record this element for all shotcrete cross passageways. Cross passageways are typically oriented transverse to the tunnel bores and are comprised of doors to allow egress between separated tunnel bores.

The total length of cross passageways is the sum of all the lengths of each cross passageway.

See Concrete Cross Passageway (10031) for condition state specifications.

10034	Timber Cross Passageway	Units - LF
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Record this element for all timber cross passageways. Cross passageways are typically oriented transverse to the tunnel bores and are comprised of doors to allow egress between separated tunnel bores.

The total length of cross passageways is the sum of all the lengths of each cross passageway.

1. Defects are superficial and have no effect on the structural capacity of the tunnel. Timber distortion has no off-set or misalignment between the timber members with good compression fit.
2. Cross Passageway length with decay that has started in the timber sets or lagging, no fungus growth or discoloration is present. Small voids may exist in the annular space behind the lagging. Cracks, splits, or checks may exist in the timber sets or lagging. Distortion or misalignment between timber members may exist but is 0.125 in. or less. Insect infestation has started in the timber sets or lagging. Connections have loose bolts, or fasteners are present, but the connections are in place and functioning as intended. Timber surfaces are saturated indicating seepage may be present or evidence of past seepage.
3. Cross Passageway length with structural defects. Decay has resulted in loss of strength, deflection, or crushing of the element but not of a sufficient magnitude to affect the strength and serviceability of the tunnel. Fungus growth and discoloration is present. Large voids may exist in the annular space behind the lagging. Cracks, splits or checks exist in the timber sets or lagging and has impacted strength and/or serviceability but does not warrant a structural review. Distortion or misalignment between timber members may exist and is between 0.125 in. and 0.25 in. Insect infestation exists in the timber sets or lagging and has produced loss of strength or deflection of the element but not of a sufficient magnitude to affect the strength and/or serviceability of the tunnel. Connections have missing bolts or fasteners but does not require a structural review. Timber surfaces are fully saturated with seepage.
4. Cross Passageway condition warrants a structural review to determine the effect of strength or serviceability of the element or tunnel, OR a structural review has been completed and the defects impact strength and serviceability of the element or tunnel. Surfaces may have areas with seepage that ranges from dripping to flowing.

10035	Masonry Cross Passageway	Units - LF
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Record this element for all masonry cross passageways. Cross passageways are typically oriented transverse to the tunnel bores and are comprised of doors to allow egress between separated tunnel bores.

The total length of cross passageways is the sum of all the lengths of each cross passageway.

1. Defects are superficial and have no effect on the structural capacity of the tunnel. Surface is dry.
2. Cross Passageway length with cracking or voids in less than 10% of joints. Efflorescence may include white surfaces without build-up or leaching without rust staining. Block or stone has split or spalled with no shifting and all patching is sound. Block or stone has only shifted slightly out of alignment. Distortion has received structural review and has been mitigated. Saturated surface indicating seepage may be present or evidence of past seepage.
3. Cross Passageway length of efflorescence may exist with heavy build-up and rust staining. There is cracking or voids in 10% or more of the joints. Block and stone have split or spalled with shifting but does not warrant a structural review and/or patching is unsound. Block or stone has shifted significantly out of alignment or is missing but does not warrant structural review. Distortion has received structural review and does not require mitigation. Surface is fully saturated with seepage.
4. Cross Passageway condition warrants a structural review to determine the effect of strength or serviceability of the element or tunnel, OR a structural review has been completed and the defects impact strength and serviceability of the element or tunnel. Surfaces may have areas with seepage that ranges from dripping to flowing.

10036	Unlined/Rock Cross Passageway	Units – LF
<p>Record this element for all unlined rock cross passageways. Cross passageways are typically oriented transverse to the tunnel bores and are comprised of doors to allow egress between separated tunnel bores.</p>		
<p>The total length of cross passageways is the sum of all the lengths of each cross passageway.</p>		
<ol style="list-style-type: none"> 1. Passageway has no drummy rock, blocks, or slabs apparent, and no shear zones are in evidence. There are no displacements visible along joints and cracks, and the surface is dry. 2. Passageway length has rockfall with any blocks or slabs that are tightly interlocked with the surrounding rock and are not in danger of separating from the parent rock mass. Any displacements along shear zones, joints, or cracks appear to be old, i.e., to have come about prior to the existence of the tunnel. The drummy areas are less than or equal to 1.0 ft. in diameter. All patches are sound. Saturated surface indicating seepage may be present or evidence of past seepage. 3. Passageway length has rockfall with any blocks or slabs that are not tightly interlocked with the surrounding rock that are less than 1 ft. in diameter. Displacements along shear zones, joints, or cracks have occurred since construction. The drummy areas are greater than 1.0 ft in diameter. Patches are unsound. Surface is fully saturated with seepage. 4. Passageway condition warrants a structural review to determine the effect of strength or serviceability of the element or tunnel, OR a structural review has been completed and the defects impact strength and serviceability of the element or tunnel. Passageway may have areas with seepage that ranges from dripping to flowing. 		
10039	Other Cross Passageway	Units – LF
<p>Record this element for all other cross passageways. Cross passageways are typically oriented transverse to the tunnel bores and are comprised of doors to allow egress between separated tunnel bores.</p>		
<p>The total length of cross passageways is the sum of all the lengths of each cross passageway.</p>		
<ol style="list-style-type: none"> 1. Defects are superficial and have no effect on structural capacity. Cracks may be present but they have not allowed for the rock to shift. Surfaces are dry. 2. Cross Passageway length where cracks are present and rock has minor shifting and all patches are sound. Distortion has received structural review and has been mitigated. A saturated surface may indicate present or previous seepage. 3. Cross Passageway length where rocks are cracked with face deformation and rocks are missing and patches are unsound. Distortion has received structural review and does not need mitigation. Surface is fully saturated with seepage. 4. Cross Passageway condition warrants a structural review to determine the effect of strength or serviceability of the element or tunnel, OR a structural review has been completed and the defects impact strength and serviceability of the element or tunnel. Seepage could range from dripping to flowing. 		

Tunnel Interior Walls

10041	Concrete Interior Walls	Units – SF
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Record this element for all concrete interior walls. This element defines those internal walls in tunnels which are usually placed to separate traffic travelling in opposite directions. The internal wall also serves as a barrier between tunnel segments in an emergency to protect evacuees from smoke inhalation, fire or hazardous conditions.

The area of the interior wall is the product of the length (along the centerline) of the tunnel and the height.

1. Defects are superficial and have no effect on the structural capacity of the interior wall. Cracking may exist with widths less than 0.012 in. or spacing greater than 5.0 ft.
2. Interior Wall area with delamination's, spalls 1 in. or less deep or 6 in. or less diameter, and/or patched areas that are sound. Areas of exposed rebar may be present but without measurable section loss. Efflorescence may include white surfaces without build-up or leaching without rust staining. Cracking in liners may exist with widths 0.012 – 0.10 in. or spacing between 1.0 – 5.0 ft.
3. Interior Wall area with structural defects that do not require a structural review or may require a structural review but does not require mitigation. Spalls greater than 1.0 in. deep or greater than 6 in. diameter may exist, patched areas are unsound or showing distress. Areas of exposed rebar are present with measurable section loss. Areas of efflorescence may exist with heavy build-up and rust staining. Cracking may exist with widths greater than 0.10 in. below the spring line or greater than 0.012 in. above the spring line or spacing less than 1.0 ft.
4. Interior Wall area condition warrants a structural review to determine the effect of strength or serviceability of the element or tunnel, OR a structural review has been completed and the defects impact strength and serviceability of the element or tunnel.

10049	Other Interior Walls	Units – SF
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Record this element for all interior walls composed of other materials. This element defines those internal walls in tunnels which are usually placed to separate traffic travelling in opposite directions. The internal wall also serves as a barrier between tunnel segments in an emergency to protect evacuees from smoke inhalation, fire or hazardous conditions.

The area of the interior wall is the product of the length (along the centerline) of the tunnel and the height.

1. Interior Wall is in good condition with no notable distress.
2. Interior Wall is in fair condition with isolated breakdowns or deterioration.
3. Interior Wall is in poor condition with widespread deterioration or breakdowns without reducing load capacity.
4. Interior Wall area condition warrants a structural review to determine the effect of strength or serviceability of the element or tunnel, OR a structural review has been completed and the defects impact strength and serviceability of the element or tunnel.

Tunnel Portal

10051	Concrete Portal	Units – SF
<p>Record this element for all concrete portals. This element defines the portal façade, which comprise the architectural/structural that are above the roadway at the opening of the tunnel bore.</p>		
<p>The area of the portal is the product of the width and height of the portal minus the area of the roadway opening. The area may include wingwalls which retain soil and rock near the portal but does not include walls leading up to the portal.</p>		
<ol style="list-style-type: none"> <li data-bbox="285 531 1370 600">1. Defects are superficial and have no effect on the structural capacity of the portal. Cracking may exist with widths less than 0.012 in. or spacing greater than 5.0 ft. <li data-bbox="285 621 1468 831">2. Portal area with delamination's, spalls 1 in. or less deep or 6 in. or less diameter, and/or patched areas that are sound. Areas of exposed rebar may be present but without measurable section loss. Efflorescence may include white surfaces without build-up or leaching without rust staining. Cracking may exist with widths 0.012 – 0.10 in. or spacing between 1.0 – 5.0 ft. Settlement exists within tolerable limits or is arrested with no observed structural distress. <li data-bbox="285 852 1468 1104">3. Portal area with structural defects that do not require a structural review. Spalls greater than 1.0 in. deep or greater than 6 in. diameter may exist, patched areas are unsound or showing distress. Areas of exposed rebar are present with measurable section loss. Areas of efflorescence may exist with heavy build-up and rust staining. Cracking may exist with widths greater than 0.10 in. below the spring line or greater than 0.012 in. above the spring line or spacing less than 1.0 ft. Settlement exceeds tolerable limits but does not warrant structural review. <li data-bbox="285 1125 1450 1236">4. Portal area condition warrants a structural review to determine the effect of strength or serviceability of the element or tunnel, OR a structural review has been completed and the defects impact strength and serviceability of the element or tunnel. 		

10055	Masonry Portal	Units - SF
<p>Record this element for all masonry portals. This element defines the portal façade, which comprise the architectural/structural that are above the roadway at the opening of the tunnel bore.</p>		
<p>The area of the portal is the product of the width and height of the portal minus the area of the roadway opening. The area may include wingwalls which retain soil and rock near the portal but does not include walls leading up to the portal.</p>		
<ol style="list-style-type: none"> 1. Defects are superficial and have no effect on the structural capacity of the portal. 2. Portal area with cracking or voids in less than 10% of joints. Efflorescence may include white surfaces without build-up or leaching without rust staining. Block or stone has split or spalled with no shifting and all patching is sound. Block or stone has only shifted slightly out of alignment. Settlement exists within tolerable limits or is arrested with no observed structural distress. 3. Portal areas of efflorescence may exist with heavy build-up and rust staining. There is cracking or voids in 10% or more of the joints. Block and stone have split or spalled with shifting but does not warrant a structural review or patching is unsound. Block or stone has shifted significantly out of alignment or is missing but does not warrant structural review. Settlement exceeds tolerable limits but does not warrant structural review. 4. Portal area condition warrants a structural review to determine the effect of strength or serviceability of the element or tunnel, OR a structural review has been completed and the defects impact strength and serviceability of the element or tunnel. 		
10059	Other Portal	Units - SF
<p>Record this element for all portals composed of other materials. This element defines the portal façade, which comprise the architectural/structural that are above the roadway at the opening of the tunnel bore.</p>		
<p>The area of the portal is the product of the width and height of the portal minus the area of the roadway opening. The area may include wingwalls which retain soil and rock near the portal but does not include walls leading up to the portal.</p>		
<ol style="list-style-type: none"> 1. Portal is in good condition with no notable distress. 2. Portal is in fair condition with isolated breakdowns or deterioration. Settlement exists within tolerable limits or arrested with no observed structural distress. 3. Portal is in poor condition with widespread deterioration or breakdowns without reducing load capacity. Settlement exceeds tolerable limits but does not warrant a structural review. 4. Portal area condition warrants a structural review to determine the effect of strength or serviceability of the element or tunnel, OR a structural review has been completed and the defects impact strength and serviceability of the element or tunnel. 		

Tunnel Ceiling Slab

10061	Concrete Ceiling Slab	Units – SF
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Record this element for all concrete ceiling slabs. This element defines those structural slabs which separate the space above the roadway from the upper plenum.

The area of the ceiling slab is the product of the width and the length of the slab.

1. Defects are superficial and have no effect on the structural capacity of the ceiling slab. Cracking may exist with widths less than 0.012 in. or spacing greater than 3.0 ft.
2. Ceiling Slab area with delamination's, spalls 1 in. or less deep or 6 in. or less diameter, and/or patched areas that are sound. Areas of exposed rebar may be present but without measurable section loss. Efflorescence may include white surfaces without build-up or leaching without rust staining. Cracking may exist with widths 0.012 – 0.05 in. or spacing between 1.0 – 3.0 ft.
3. Ceiling Slab area with structural defects that do not require a structural review. Spalls greater than 1.0 in. deep or greater than 6 in. diameter may exist, patched areas are unsound or showing distress. Areas of exposed rebar are present with measurable section loss. Areas of efflorescence may exist with heavy build-up and rust staining. Cracking may exist with widths greater than 0.05 in. or spacing less than 1.0 ft.
4. Ceiling Slab area condition warrants a structural review to determine the effect of strength or serviceability of the element or tunnel, OR a structural review has been completed and the defects impact strength and serviceability of the element or tunnel.

10069	Other Ceiling Slab	Units – SF
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Record this element for all ceiling slabs composed of other materials. This element defines those structural slabs which separate the space above the roadway from the upper plenum.

The area of the ceiling slab is the product of the width and the length of the slab.

1. Ceiling Slab is in good condition with no notable distress.
2. Ceiling Slab is in fair condition with isolated breakdowns or deterioration.
3. Ceiling Slab is in poor condition with widespread deterioration or breakdowns without reducing load capacity.
4. Ceiling Slab area condition warrants a structural review to determine the effect of strength or serviceability of the element or tunnel, OR a structural review has been completed and the defects impact strength and serviceability of the element or tunnel.

Tunnel Ceiling Girder

10070	Steel Ceiling Girder	Units – LF
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Record this element for all steel ceiling girders. This element defines the girders that support the structural ceiling slabs which separate the space above the roadway from the upper plenum.

The total quantity for ceiling girder is the sum of all the lengths of each tunnel ceiling girder.

1. Defects are superficial and have no effect on the structural capacity of the tunnel. Connection is in place and functioning as intended.
2. Ceiling Girder length where corrosion of steel has initiated and there may be areas of freckled rust. Cracking that has self-arrested or has been arrested with effective arrest holes, doubling plates, or similar may exist in the liner. Connections have loose fasteners or pack rust without distortion, but the connections are in place and functioning as intended. Distortion is present and has received a structural review and has been mitigated.
3. Ceiling Girder length with structural defects that do not require a structural review or may require a structural review but does not require mitigation. Areas of corrosion may exist where section loss is evident, or pack rust is present. Cracks may exist and have not been arrested. Connections may have missing bolts, rivets, or fasteners; broken welds; or pack rust with distortion.
4. Ceiling Girder condition warrants a structural review to determine the effect of strength or serviceability of the element or tunnel, OR a structural review has been completed and the defects impact strength and serviceability of the element or tunnel.

10071	Concrete Ceiling Girder	Units – LF
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Record this element for all concrete ceiling girders. This element defines the girders that support the structural ceiling slabs which separate the space above the roadway from the upper plenum.

The total quantity for ceiling girder is the sum of all the lengths of each tunnel ceiling girder.

1. Defects are superficial and have no effect on the structural capacity of the ceiling slab. Cracking may exist with widths less than 0.012 in. or spacing greater than 3.0 ft.
2. Ceiling Girder length with delamination's, spalls 1 in. or less deep or 6 in. or less diameter, and/or patched areas that are sound. Areas of exposed rebar may be present but without measurable section loss. Efflorescence may include white surfaces without build-up or leaching without rust staining. Cracking may exist with widths 0.012 – 0.05 in. or spacing between 1.0 – 3.0 ft.
3. Ceiling Girder length with structural defects that do not require a structural review. Spalls greater than 1.0 in. deep or greater than 6 in. diameter may exist, patched areas are unsound or showing distress. Areas of exposed rebar are present with measurable section loss. Areas of efflorescence may exist with heavy build-up and rust staining. Cracking may exist with widths greater than 0.05 in. or spacing less than 1.0 ft.
4. Ceiling Girder condition warrants a structural review to determine the effect of strength or serviceability of the element or tunnel, OR a structural review has been completed and the defects impact strength and serviceability of the element or tunnel.

10072	Prestressed Concrete Ceiling Girder	Units - LF
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Record this element for all prestressed concrete ceiling girders. This element defines the girders that support the structural ceiling slabs which separate the space above the roadway from the upper plenum.

The total quantity for ceiling girder is the sum of all the lengths of each tunnel ceiling girder.

1. Defects are superficial and have no effect on the structural capacity of the tunnel. Cracking may exist with widths less than 0.004 in. or spacing greater than 3.0 ft.
2. Ceiling Girder length with delamination's, spalls 1 in. or less deep or 6 in. or less diameter, and/or patched areas that are sound. Areas of exposed rebar may be present but without measurable section loss. Efflorescence may include white surfaces without build-up or leaching without rust staining. Cracking may exist with widths 0.004 - 0.009 in. or spacing between 1.0 - 3.0 ft. Exposed prestressing is present without section loss.
3. Ceiling Girder length with structural defects that do not require a structural review or may require a structural review but does not require mitigation. Spalls greater than 1.0 in. deep or greater than 6 in. diameter may exist, patched areas are unsound or showing distress. Areas of exposed rebar are present with measurable section loss. Areas of efflorescence may exist with heavy build-up and rust staining. Cracking may exist with widths greater than 0.009 in. or spacing less than 1.0 ft. Exposed prestressing is present with section loss but does not warrant a structural review.
4. Ceiling Girder condition warrants a structural review to determine the effect of strength or serviceability of the element or tunnel, OR a structural review has been completed and the defects impact strength and serviceability of the element or tunnel.

10079	Other Ceiling Girder	Units - LF
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Record this element for all ceiling girders composed of other materials. This element defines the girders that support the structural ceiling slabs which separate the space above the roadway from the upper plenum.

The total quantity for ceiling girder is the sum of all the lengths of each tunnel ceiling girder.

1. Ceiling Girder is in good condition with no notable distress.
2. Ceiling Girder is in fair condition with isolated breakdowns or deterioration.
3. Ceiling Girder is in poor condition with widespread deterioration or breakdowns without reducing load capacity.
4. Ceiling Girder area condition warrants a structural review to determine the effect of strength or serviceability of the element or tunnel, OR a structural review has been completed and the defects impact strength and serviceability of the element or tunnel.

Tunnel Hangers/Anchors

10080	Steel Hangers and Anchorages	Units - EA
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Record this element for all steel hangers and anchorages. Hangers are tension members that support ceiling girders or ceiling panels. The anchorages of the hangers are typically attached to the tunnel roof and ceiling panels.

The total quantity for hangers and anchorages is the sum of all the number of hanger and anchorage units.

1. Defects are superficial and have no effect on the structural capacity of the tunnel. Connection is in place and functioning as intended.
2. Steel Hanger and Anchorages where corrosion of steel has initiated and there may be areas of freckled rust. There may be cracking that has self-arrested or has been arrested with effective arrest holes, doubling plates, or similar may exist in the liner. Connections have loose fasteners or pack rust without distortion, but the connections are in place and functioning as intended. Isolated hangers are bowed or elongated. Creep displacement is visible and anchorage has received a structural review and has been mitigated. There is cracking around the anchorage areas, but concrete is sound.
3. Steel Hanger and Anchorages with structural defects that do not require a structural review or may require a structural review but does not require mitigation. Areas of corrosion may exist where section loss is evident, or pack rust is present. Cracks may exist and have not been arrested. Connections may have missing bolts, rivets, or fasteners; broken welds; or pack rust with distortion. Multiple adjacent hangers are bowed and elongated and anchors has a gap greater than 0.125 in or are visibly elongated. Creep displacement is visible and anchorage has received a structural review and does not require mitigation. There is cracking and/or spalling around the anchorage areas and concrete is not sound
4. Steel Hanger and Anchorage condition warrants a structural review to determine the effect of strength or serviceability of the element or tunnel, OR a structural review has been completed and the defects impact strength and serviceability of the element or tunnel.

10089 Other Hangers and Anchorages

Units - EA

Record this element for all hangers and anchorages composed of other materials. Hangers are tension members that support ceiling girders or ceiling panels. The anchorages of the hangers are typically attached to the tunnel roof and ceiling panels.

The total quantity for hangers and anchorages is the sum of all the number of hanger and anchorage units.

1. Hanger and Anchorage are in good condition with no notable distress and connections and anchorage area are sound.
2. Hanger and Anchorages are in fair condition with isolated breakdowns or deterioration. Isolated fasteners are loose at their connections. Isolated hangers are bowed or elongated. Displacement is visible and anchorage has received structural review and has been mitigated. There is cracking around the anchorage areas, but the concrete is sound.
3. Hanger and Anchorages are in poor condition with widespread deterioration or breakdowns without reducing load capacity. Adjacent hangers are loose and/or fasteners are missing from the connections at isolated locations. Multiple adjacent hangers are bowed or elongated, and/or anchors have a gap greater than 0.125 inches or are visible elongated. Displacement is visible and anchorage has received a structural review and does not require mitigation. There is cracking or spalling around the anchorage area and the concrete is not sound.
4. Hanger and Anchorage condition warrants a structural review to determine the effect of strength or serviceability of the element or tunnel, OR a structural review has been completed and the defects impact strength and serviceability of the element or tunnel.

Tunnel Ceiling Panels

10090	Steel Ceiling Panels	Units – SF
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Record this element for all steel ceiling panels. Ceiling panels separate the upper plenum from space above the tunnel roadway. Ceiling panels are typically supported by hangers.

The area of the ceiling panel is the product of the width and length of the panel.

1. Defects are superficial and have no effect on the structural capacity of the tunnel. Connection is in place and function as needed.
2. Ceiling Panel area where corrosion of steel has initiated and there may be areas of freckled rust. Cracking that has self-arrested or has been arrested with effective arrest holes, doubling plates, or similar may exist in the liner. Connections have loose fasteners or pack rust without distortion, but the connections are in place and functioning as intended. Distortion is present and has received a structural review and has been mitigated.
3. Ceiling Panel area with structural defects that do not require a structural review or may require a structural review but does not require mitigation. Areas of corrosion may exist where section loss is evident, or pack rust is present. Cracks may exist and have not been arrested. Connections may have missing bolts, rivets, or fasteners; broken welds; or pack rust with distortion.
4. Ceiling Panel area condition warrants a structural review to determine the effect of strength or serviceability of the element or tunnel, OR a structural review has been completed and the defects impact strength and serviceability of the element or tunnel.

10091	Concrete Ceiling Panels	Units – SF
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Record this element for all concrete ceiling panels. Ceiling panels separate the upper plenum from space above the tunnel roadway. Ceiling panels are typically supported by hangers.

The area of the ceiling panel is the product of the width and length of the panel.

1. Defects are superficial and have no effect on the structural capacity of the ceiling panel. Cracking may exist with widths less than 0.012 in. or spacing greater than 3.0 ft.
2. Ceiling Panel area with delamination's, spalls 1 in. or less deep or 6 in. or less diameter, and/or patched areas that are sound. Areas of exposed rebar may be present but without measurable section loss. Efflorescence may include white surfaces without build-up or leaching without rust staining. Cracking may exist with widths 0.012 – 0.05 in. or spacing between 1.0 – 3.0 ft.
3. Ceiling Panel area with structural defects that do not require a structural review. Spalls greater than 1.0 in. deep or greater than 6 in. diameter may exist, patched areas are unsound or showing distress. Areas of exposed rebar are present with measurable section loss. Areas of efflorescence may exist with heavy build-up and rust staining. Cracking may exist with widths greater than 0.05 in. or spacing less than 1.0 ft.
4. Ceiling Panel area condition warrants a structural review to determine the effect of strength or serviceability of the element or tunnel, OR a structural review has been completed and the defects impact strength and serviceability of the element or tunnel.

10099	Other Ceiling Panels	Units - SF
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Record this element for all ceiling panels composed of other materials. Ceiling panels separate the upper plenum from space above the tunnel roadway. Ceiling panels are typically supported by hangers.

The area of the ceiling panel is the product of the width and length of the panel.

1. Ceiling Panel is in good condition with no notable distress.
2. Ceiling Panel is in fair condition with isolated breakdowns or deterioration.
3. Ceiling Panel is in poor condition with widespread deterioration or breakdowns without reducing load capacity.
4. Ceiling Panel area condition warrants a structural review to determine the effect of strength or serviceability of the element or tunnel, OR a structural review has been completed and the defects impact strength and serviceability of the element or tunnel.

Tunnel Invert Slab

10101	Concrete Invert Slab	Units - SF
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Record this element for all concrete invert slabs. This element defines those structural slabs which support the roadway and traffic loads.

The total area of the invert slab is the product of the width and length of the slab.

1. Defects are superficial and have no effect on the structural capacity of the invert slab. Cracking may exist with widths less than 0.012 in. or spacing greater than 3.0 ft.
2. Invert Slab area with delamination's, spalls 1 in. or less deep or 6 in. or less diameter, and/or patched areas that are sound. Areas of exposed rebar may be present but without measurable section loss. Efflorescence may include white surfaces without build-up or leaching without rust staining. Cracking may exist with widths 0.012 - 0.05 in. or spacing between 1.0 - 3.0 ft.
3. Invert Slab area with structural defects that do not require a structural review. Spalls greater than 1.0 in. deep or greater than 6 in. diameter may exist, patched areas are unsound or showing distress. Areas of exposed rebar are present with measurable section loss. Areas of efflorescence may exist with heavy build-up and rust staining. Cracking may exist with widths greater than 0.05 in. or spacing less than 1.0 ft.
4. Invert Slab area condition warrants a structural review to determine the effect of strength or serviceability of the element or tunnel, OR a structural review has been completed and the defects impact strength and serviceability of the element or tunnel.

10109	Other Invert Slab	Units - SF
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Record this element for all invert slabs composed of other materials. This element defines those structural slabs which support the roadway and traffic loads.

The total area of the invert slab is the product of the width and length of the slab.

1. Invert Slab is in good condition with no notable distress.
2. Invert Slab is in fair condition with isolated breakdowns or deterioration.
3. Invert Slab is in poor condition with widespread deterioration or breakdowns without reducing load capacity.
4. Invert Slab area condition warrants a structural review to determine the effect of strength or serviceability of the element or tunnel, OR a structural review has been completed and the defects impact strength and serviceability of the element or tunnel.

Tunnel Slab on Grade

10111	Concrete Slab on Grade	Units – SF
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Record this element for all concrete slabs-on-grade. This element defines a slab that is supported continuously on a subbase material.

The area of the slab-on-grade is the product of the width and length of the slab.

1. Defects are superficial and have no effect on the structural capacity of the slab-on-grade. Cracking may exist with widths less than 0.012 in. or spacing greater than 3.0 ft.
2. Slab-on-Grade area with delamination's, spalls 1 in. or less deep or 6 in. or less diameter, and/or patched areas that are sound. Areas of exposed rebar may be present but without measurable section loss. Settlement exists with tolerable limits or is arrested with no observed structural distress. Cracking may exist with widths 0.012 – 0.05 in. or spacing between 1.0 – 3.0 ft.
3. Slab-on-Grade area with structural defects that do not require a structural review. Spalls greater than 1.0 in. deep or greater than 6 in. diameter may exist, patched areas are unsound or showing distress. Areas of exposed rebar are present with measurable section loss. Settlement exceeds tolerable limits but does not require a structural review. Cracking may exist with widths greater than 0.05 in. or spacing less than 1.0 ft.
4. Slab-on-Grade area condition warrants a structural review to determine the effect of strength or serviceability of the element or tunnel, OR a structural review has been completed and the defects impact strength and serviceability of the element or tunnel.

10119	Other Slab on Grade	Units – SF
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Record this element for all slabs-on-grade composed of other materials. This element defines a slab that is supported continuously on a subbase material.

The area of the slab-on-grade is the product of the width and length of the slab.

1. Slab-on-Grade is in good condition with no notable distress.
2. Slab-on-Grade is in fair condition with isolated breakdowns or deterioration. Settlement exists within tolerable limits or arrested with no observed structural distress.
3. Slab-on-Grade is in poor condition with widespread deterioration or breakdowns without reducing load capacity. Settlement exceeds tolerable limits but does not warrant a structural review.
4. Slab-on-Grade area condition warrants a structural review to determine the effect of strength or serviceability of the element or tunnel, OR a structural review has been completed and the defects impact strength and serviceability of the element or tunnel.

Tunnel Invert Girder

10120	Steel Invert Girder	Units - LF
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Record this element for all steel invert girders. This element defines the invert girders which support the invert slabs.

The total quantity for invert girder is the sum of all the lengths of each invert girder.

1. Defects are superficial and have no effect on the structural capacity of the invert girder. Connection is in place and function as needed.
2. Invert Girder length where corrosion of steel has initiated and there may be areas of freckled rust. Cracking that has self-arrested or has been arrested with effective arrest holes, doubling plates, or similar may exist in the liner. Connections have loose fasteners or pack rust without distortion, but the connections are in place and functioning as intended. Distortion is present and has received a structural review and has been mitigated.
3. Invert Girder length with structural defects that do not require a structural review or may require a structural review but does not require mitigation. Areas of corrosion may exist where section loss is evident, or pack rust is present. Cracks may exist and have not been arrested. Connections may have missing bolts, rivets, or fasteners; broken welds; or pack rust with distortion.
4. Invert Girder condition warrants a structural review to determine the effect of strength or serviceability of the element or tunnel, OR a structural review has been completed and the defects impact strength and serviceability of the element or tunnel.

10121	Concrete Invert Girder	Units - LF
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Record this element for all concrete invert girders. This element defines the invert girders which support the invert slabs.

The total quantity for invert girder is the sum of all the lengths of each invert girder.

1. Defects are superficial and have no effect on the structural capacity of the invert girder. Cracking may exist with widths less than 0.012 in. or spacing greater than 3.0 ft.
2. Invert Girder length with delamination's, spalls 1 in. or less deep or 6 in. or less diameter, and/or patched areas that are sound. Areas of exposed rebar may be present but without measurable section loss. Efflorescence may include white surfaces without build-up or leaching without rust staining. Cracking may exist with widths 0.012 - 0.05 in. or spacing between 1.0 - 3.0 ft.
3. Invert Girder length with structural defects that do not require a structural review. Spalls greater than 1.0 in. deep or greater than 6 in. diameter may exist, patched areas are unsound or showing distress. Areas of exposed rebar are present with measurable section loss. Areas of efflorescence may exist with heavy build-up and rust staining. Cracking may exist with widths greater than 0.05 in. or spacing less than 1.0 ft.
4. Invert Girder condition warrants a structural review to determine the effect of strength or serviceability of the element or tunnel, OR a structural review has been completed and the defects impact strength and serviceability of the element or tunnel.

10122	Prestressed Concrete Invert Girder	Units - LF
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Record this element for all prestressed concrete invert girders. This element defines the invert girders which support the invert slabs. The total quantity for invert girder is the sum of all the lengths of each invert girder.

1. Defects are superficial and have no effect on the structural capacity of the tunnel. Cracking may exist with widths less than 0.004 in. or spacing greater than 3.0 ft.
2. Invert Girder length with delamination's, spalls 1 in. or less deep or 6 in. or less diameter, and/or patched areas that are sound. Areas of exposed rebar may be present but without measurable section loss. Efflorescence may include white surfaces without build-up or leaching without rust staining. Cracking may exist with widths 0.004 - 0.009 in. or spacing between 1.0 - 3.0 ft. Exposed prestressing is present without section loss.
3. Invert Girder length with structural defects that do not require a structural review or may require a structural review but does not require mitigation. Spalls greater than 1.0 in. deep or greater than 6 in. diameter may exist, patched areas are unsound or showing distress. Areas of exposed rebar are present with measurable section loss. Areas of efflorescence may exist with heavy build-up and rust staining. Cracking may exist with widths greater than 0.009 in. or spacing less than 1.0 ft. Exposed prestressing is present with section loss but does not warrant a structural review.
4. Invert Girder condition warrants a structural review to determine the effect of strength or serviceability of the element or tunnel, OR a structural review has been completed and the defects impact strength and serviceability of the element or tunnel.

10129	Other Invert Girder	Units - LF
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Record this element for all invert girders composed of other materials. This element defines the invert girders which support the invert slabs. The total quantity for invert girder is the sum of all the lengths of each invert girder.

1. Invert Girder is in good condition with no notable distress.
2. Invert Girder is in fair condition with isolated breakdowns or deterioration.
3. Invert Girder is in poor condition with widespread deterioration or breakdowns without reducing load capacity.
4. Invert Girder area condition warrants a structural review to determine the effect of strength or serviceability of the element or tunnel, OR a structural review has been completed and the defects impact strength and serviceability of the element or tunnel.

Tunnel Joints

10130	Tunnel Strip Seal Joint	Units - LF
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Record this element for all strip seal expansion joints. This element defines those roadway and tunnel expansion joint devices which utilize a neoprene type waterproof gland with some type of metal extrusion or other system to anchor the gland.

The total quantity for expansion joints is the sum of all the lengths of each joint.

1. Seal adhesion is fully adhered. No debris to a shallow cover of loose debris may be evident but does not affect the performance of the joint. Adjacent deck or header is sound with no spalling, delamination or unsound patch.
2. Seal joint has minimal leakage with minor dripping through the joint. The seal is adhered for more than 50% of the joint height and there are no punctures with only surface cracks. Debris is only partially filled with hard-packed material, but still allows free movement. Adjacent deck or header has edge delamination or spalling 1 in or less deep or 6 in or less in diameter with no exposed rebar and patching that is sound. Metal has freckled rust, no cracks, or impact damage and may be loose but functioning as usual.
3. Leakage is moderate with more than a drip but less than free flow of water. The seal is adhered 50% or less of the joint height but there is still some adhesion, punctured, ripped, or partially pulled out, and/or has cracks that partially penetrate the seal. Debris is filled completely and impacts joint movement. Adjacent deck or header has edge delamination or spalling greater than 1 in deep or 6 in or more in diameter with exposed rebar and patching that is unsound, making the joint loose. Metal has section loss, missing or broken fasteners, cracking, or impact damage but the joint is still functioning.
4. There is a free flow of water through the joint. The seal has a complete loss of adhesion, is punctured through completely, pulled out, or missing, and/or a crack has fully penetrated the seal. Debris is filled completely and prevents joint movement. Spall, delamination, unsound patched area or loose joint anchor that prevents the joint from functioning as intended on the adjacent deck or header. The metal is cracking with section loss, damage, or connection failure that prevents the joint from functioning as intended.

10131	Tunnel Pourable Joint Seal	Units - LF
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Record this element for all pourable joint seals. This element defines those roadway and tunnel joints filled with a pourable seal with or without a backer.

The total quantity for expansion joints is the sum of all the lengths of each joint.

1. Seal adhesion is fully adhered. No debris to a shallow cover of loose debris may be evident but does not affect the performance of the joint. Adjacent deck or header is sound with no spalling, delamination or unsound patch.
2. Seal joint has minimal leakage with minor dripping through the joint. The seal is adhered for more than 50% of the joint height and there are no punctures with only surface cracks. Debris is only partially filled with hard-packed material, but still allows free movement. Adjacent deck or header has edge delamination or spalling 1 in or less deep or 6 in or less in diameter with no exposed rebar and patching that is sound.
3. Leakage is moderate with more than a drip but less than free flow of water. The seal is adhered 50% or less of the joint height but there is still some adhesion, punctured, ripped, or partially pulled out, and/or has cracks that partially penetrate the seal. Debris is filled completely and impacts joint movement. Adjacent deck or header has edge delamination or spalling greater than 1 in deep or 6 in or more in diameter with exposed rebar and patching that is unsound, making the joint loose.
4. There is a free flow of water through the joint. The seal has a complete loss of adhesion, is punctured through completely, pulled out, or missing, and/or a crack has fully penetrated the seal. Debris is filled completely and prevents joint movement. Spall, delamination, unsound patched area or loose joint anchor that prevents the joint from functioning as intended on the adjacent deck or header.

10132	Tunnel Compression Seal	Units - LF
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Record this element for all compression joint seals. This element defines those roadway and tunnel joints filled with a preformed compression type seal. This joint does not have an anchor system to confine the seal.

The total quantity for expansion joints is the sum of all the lengths of each joint.

1. Seal adhesion is fully adhered. No debris to a shallow cover of loose debris may be evident but does not affect the performance of the joint. Adjacent deck or header is sound with no spalling, delamination or unsound patch.
2. Seal joint has minimal leakage with minor dripping through the joint. The seal is adhered for more than 50% of the joint height and there are no punctures with only surface cracks. Debris is only partially filled with hard-packed material, but still allows free movement. Adjacent deck or header has edge delamination or spalling 1 in or less deep or 6 in or less in diameter with no exposed rebar and patching that is sound.
3. Leakage is moderate with more than a drip but less than free flow of water. The seal is adhered 50% or less of the joint height but there is still some adhesion, punctured, ripped, or partially pulled out, and/or has cracks that partially penetrate the seal. Debris is filled completely and impacts joint movement. Adjacent deck or header has edge delamination or spalling greater than 1 in deep or 6 in or more in diameter with exposed rebar and patching that is unsound, making the joint loose.
4. There is a free flow of water through the joint. The seal has a complete loss of adhesion, is punctured through completely, pulled out, or missing, and/or a crack has fully penetrated the seal. Debris is filled completely and prevents joint movement. Spall, delamination, unsound patched area or loose joint anchor that prevents the joint from functioning as intended on the adjacent deck or header.

10133	Tunnel Assembly Joint w/ Seal	Units - LF
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Record this element for all assembly joints with seals. This element defines only those roadway and tunnel joints filled with an assembly mechanism that have a seal.

The total quantity for expansion joints is the sum of all the lengths of each joint.

1. Seal adhesion is fully adhered. No debris to a shallow cover of loose debris may be evident but does not affect the performance of the joint. Adjacent deck or header is sound with no spalling, delamination or unsound patch.
2. Seal joint has minimal leakage with minor dripping through the joint. The seal is adhered for more than 50% of the joint height and there are no punctures with only surface cracks. Debris is only partially filled with hard-packed material, but still allows free movement. Adjacent deck or header has edge delamination or spalling 1 in or less deep or 6 in or less in diameter with no exposed rebar and patching that is sound. Metal has freckled rust, no cracks, or impact damage and may be loose but functioning as usual.
3. Leakage is moderate with more than a drip but less than free flow of water. The seal is adhered 50% or less of the joint height but there is still some adhesion, punctured, ripped, or partially pulled out, and/or has cracks that partially penetrate the seal. Debris is filled completely and impacts joint movement. Adjacent deck or header has edge delamination or spalling greater than 1 in deep or 6 in or more in diameter with exposed rebar and patching that is unsound, making the joint loose. Metal has section loss, missing or broken fasteners, cracking, or impact damage but the joint is still functioning.
4. There is a free flow of water through the joint. The seal has a complete loss of adhesion, is punctured through completely, pulled out, or missing, and/or a crack has fully penetrated the seal. Debris is filled completely and prevents joint movement. Spall, delamination, unsound patched area or loose joint anchor that prevents the joint from functioning as intended on the adjacent deck or header. The metal is cracking with section loss, damage, or connection failure that prevents the joint from functioning as intended.

10134	Tunnel Open Expansion Joint	Units - LF
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Record this element for all open expansion joints. This element defines only those roadway and tunnel joints that are open and not sealed.

The total quantity for expansion joints is the sum of all the lengths of each joint.

1. No debris to a shallow cover of loose debris may be evident but does not affect the performance of the joint. Adjacent deck or header is sound with no spalling, delamination or unsound patch.
2. Debris is only partially filled with hard-packed material, but still allows free movement. Adjacent deck or header has edge delamination or spalling 1 in or less deep or 6 in or less in diameter with no exposed rebar and patching that is sound.
3. Debris is filled completely and impacts joint movement. Adjacent deck or header has edge delamination or spalling greater than 1 in deep or 6 in or more in diameter with exposed rebar and patching that is unsound, making the joint loose.
4. Debris is filled completely and prevents joint movement. Spall, delamination, unsound patched area or loose joint anchor that prevents the joint from functioning as intended on the adjacent deck or header.

10135	Tunnel Assembly Joint without Seal	Units - LF
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Record this element for all assembly joints without seals. This element defines only those roadway and tunnel assembly joints that are open and not sealed. These joints include finger and sliding plate joints.

The total quantity for expansion joints is the sum of all the lengths of each joint.

1. No debris to a shallow cover of loose debris may be evident but does not affect the performance of the joint. Adjacent deck or header is sound with no spalling, delamination or unsound patch.
2. Debris is only partially filled with hard-packed material, but still allows free movement. Adjacent deck or header has edge delamination or spalling 1 in or less deep or 6 in or less in diameter with no exposed rebar and patching that is sound. Metal has freckled rust, no cracks, or impact damage and may be loose but functioning as usual.
3. Debris is filled completely and impacts joint movement. Adjacent deck or header has edge delamination or spalling greater than 1 in deep or 6 in or more in diameter with exposed rebar and patching that is unsound, making the joint loose. Metal has section loss, missing or broken fasteners, cracking, or impact damage but the joint is still functioning.
4. Debris is filled completely and prevents joint movement. Spall, delamination, unsound patched area or loose joint anchor that prevents the joint from functioning as intended on the adjacent deck or header. The metal is cracking with section loss, damage, or connection failure that prevents the joint from functioning as intended.

10139	Other Tunnel Joint	Units - LF
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Record this element for all other expansion joints. This element defines those roadway and tunnel expansion joint devices which utilize a neoprene type waterproof gland with some type of metal extrusion or other system to anchor the gland.

The total quantity for expansion joints is the sum of all the lengths of each joint.

1. No debris to a shallow cover of loose debris may be evident but does not affect the performance of the joint. Adjacent deck or header is sound with no spalling, delamination or unsound patch.
2. Seal joint has minimal leakage with minor dripping through the joint. Debris is only partially filled with hard-packed material, but still allows free movement. Adjacent deck or header has edge delamination or spalling 1 in or less deep or 6 in or less in diameter with no exposed rebar and patching that is sound. Metal has freckled rust, no cracks, or impact damage and may be loose but functioning as usual.
3. Leakage is moderate with more than a drip but less than free flow of water. Debris is filled completely and impacts joint movement. Adjacent deck or header has edge delamination or spalling greater than 1 in deep or 6 in or more in diameter with exposed rebar and patching that is unsound, making the joint loose. Metal has section loss, missing or broken fasteners, cracking, or impact damage but the joint is still functioning.
4. There is a free flow of water through the joint. Debris is filled completely and prevents joint movement. Spall, delamination, unsound patched area or loose joint anchor that prevents the joint from functioning as intended on the adjacent deck or header. The metal is cracking with section loss, damage, or connection failure that prevents the joint from functioning as intended.

10140	Gaskets	Units - LF
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These joints are design to prevent water from penetrating a tunnel liner such as the seal between a segmental tunnel liner. The condition states focus on leakage and other SNTI defects such as header conditions should be ignored.

1. Seal adhesion is fully adhered. No debris to a shallow cover of loose debris may be evident but does not affect the performance of the joint. Adjacent deck or header is sound with no spalling, delamination or unsound patch.
2. Seal joint has minimal leakage with minor dripping through the joint. The seal is adhered for more than 50% of the joint height and there are no punctures with only surface cracks. Debris is only partially filled with hard-packed material, but still allows free movement. Adjacent deck or header has edge delamination or spalling 1 in or less deep or 6 in or less in diameter with no exposed rebar and patching that is sound. Metal has freckled rust, no cracks, or impact damage and may be loose but functioning as usual.
3. Leakage is moderate with more than a drip but less than free flow of water. The seal is adhered 50% or less of the joint height but there is still some adhesion, punctured, ripped, or partially pulled out, and/or has cracks that partially penetrate the seal. Debris is filled completely and impacts joint movement. Adjacent deck or header has edge delamination or spalling greater than 1 in deep or 6 in or more in diameter with exposed rebar and patching that is unsound, making the joint loose. Metal has section loss, missing or broken fasteners, cracking, or impact damage but the joint is still functioning.
4. There is a free flow of water through the joint. The seal has a complete loss of adhesion, is punctured through completely, pulled out, or missing, and/or a crack has fully penetrated the seal. Debris is filled completely and prevents joint movement. Spall, delamination, unsound patched area or loose joint anchor that prevents the joint from functioning as intended on the adjacent deck or header. The metal is cracking with section loss, damage, or connection failure that prevents the joint from functioning as intended.

Tunnel Wearing Surface

10151	Concrete Wearing Surface	Units- SF
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This element defines a roadway surface made of Portland Cement Concrete Pavement (PCCP). The condition states do not address faulting, cracking, or smoothness of the profile at this time, but these defects should be described in the element notes. The quantity should equal the overlay's width times the length.

1. Defects are superficial and have no effect on the structural capacity of the wearing surface. Cracking may exist with widths less than 0.012 in. or spacing greater than 3.0 ft.
2. Wearing surface area with delamination's, spalls 1 in. or less deep or 6 in. or less diameter, and/or patched areas that are sound. Cracking may exist with widths 0.012 - 0.05 in. or spacing between 1.0 - 3.0 ft. The wearing surface is substantially effective and deterioration of the protected element has slowed.
3. Wearing surface area with structural defects that do not require a structural review or may require a structural review but does not require mitigation. Spalls greater than 1.0 in. deep or greater than 6 in. diameter may exist, patched areas are unsound or showing distress or a full depth pothole. Cracking may exist with widths greater than 0.05 in. or spacing less than 1.0 ft. The wearing surface has limited effectiveness and deterioration of the protected element has progressed.
4. The concrete wearing surface is no longer effective.

10158	Asphalt Wearing Surface	Units- SF
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This element defines a roadway surface made of Asphalt Concrete Pavement (ACP), Hot Mixed Asphalt (HMA), or covered with a Bituminous Surface Treatment (BST) which is also called a Chip Seal. The condition states do not address faulting, cracking, or smoothness of the profile currently. The quantity should equal the overlay's width times the length.

1. Wearing surface is in good condition and is fully effective with no evidence of leakage or further deterioration of the protected element.
2. Wearing surface is in fair condition with isolated breakdowns or deterioration and is substantially effective. Deterioration has slowed.
3. Wearing surface is in poor condition with widespread deterioration or breakdowns without reducing load capacity and has limited effectiveness. Deterioration has progressed.
4. The wearing surface is no longer effective.

10159	Other Wearing Surface	Units- SF
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This tunnel element defines a roadway surface, or top layer, that is not asphalt or concrete such as a polyester, epoxy, or cementitious overlay on the roadway. The quantity should equal the overlay's width times the length.

1. Wearing Surface is in good condition with no notable distress. It is fully effective with no evidence of leakage or further deterioration of the protected element.
2. Wearing Surface is in fair condition with isolated breakdowns or deterioration. It is substantially effective and deterioration of the protected element has slowed.
3. Wearing Surface is in poor condition with widespread deterioration or breakdowns without reducing load capacity. It has limited effectiveness and deterioration of the protected element has progressed.
4. The wearing surface is no longer effective.

Tunnel Traffic Barrier

10160	Steel Traffic Barrier	Units - LF
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Record this element for all steel traffic barriers. This element defines those tunnel barriers adjacent to a roadway. Horizontal members must be steel; however, posts may be made of steel, timber, concrete or other materials.

The total quantity for traffic barrier is the sum of all the lengths of each traffic barrier.

1. Defects are superficial and have no effect on the structural capacity of the barrier. Connection is in place and function as needed.
2. Traffic Barrier length where corrosion of steel has initiated and there may be areas of freckled rust. Cracking that has self-arrested or has been arrested with effective arrest holes, doubling plates, or similar may exist in the liner. Connections have loose fasteners or pack rust without distortion, but the connections are in place and functioning as intended. Distortion is present and has received a structural review and has been mitigated.
3. Traffic Barrier length with structural defects that do not require a structural review or may require a structural review but does not require mitigation. Areas of corrosion may exist where section loss is evident, or pack rust is present. Cracks may exist and have not been arrested. Connections may have missing bolts, rivets, or fasteners; broken welds; or pack rust with distortion.
4. Traffic Barrier condition warrants a structural review to determine the effect of strength or serviceability of the element or tunnel, OR a structural review has been completed and the defects impact strength and serviceability of the element or tunnel.

10161	Concrete Traffic Barrier	Units - LF
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Record this element for all concrete traffic barriers. This element defines those tunnel barriers adjacent to a roadway. All element of the barrier must be concrete.

The total quantity for traffic barrier is the sum of all the lengths of each traffic barrier.

1. Defects are superficial and have no effect on the structural capacity of the barrier. Cracking may exist with widths less than 0.012 in. or spacing greater than 3.0 ft.
2. Traffic Barrier length with delamination's, spalls 1 in. or less deep or 6 in. or less diameter, and/or patched areas that are sound. Areas of exposed rebar may be present but without measurable section loss. Efflorescence may include white surfaces without build-up or leaching without rust staining. Cracking may exist with widths 0.012 - 0.05 in. or spacing between 1.0 - 3.0 ft.
3. Traffic Barrier length with structural defects that do not require a structural review. Spalls greater than 1.0 in. deep or greater than 6 in. diameter may exist, patched areas are unsound or showing distress. Areas of exposed rebar are present with measurable section loss. Areas of efflorescence may exist with heavy build-up and rust staining. Cracking may exist with widths greater than 0.05 in. or spacing less than 1.0 ft.
4. Traffic Barrier condition warrants a structural review to determine the effect of strength or serviceability of the element or tunnel, OR a structural review has been completed and the defects impact strength and serviceability of the element or tunnel.

10169	Other Traffic Barrier	Units - LF
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Record this element for all traffic barriers composed of other materials. This element defines those tunnel barriers adjacent to a roadway.

The total quantity for traffic barrier is the sum of all the lengths of each traffic barrier.

1. Traffic Barrier is in good condition with no notable distress.
2. Traffic Barrier is in fair condition with isolated breakdowns or deterioration.
3. Traffic Barrier is in poor condition with widespread deterioration or breakdowns without reducing load capacity.
4. Traffic Barrier condition warrants a structural review to determine the effect of strength or serviceability of the element or tunnel, OR a structural review has been completed and the defects impact strength and serviceability of the element or tunnel.

Tunnel Pedestrian Barrier

10170	Steel Pedestrian Railing	Units – LF
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Record this element for all steel pedestrian railing. This element defines those tunnel railings adjacent to a walkway.

The total quantity for pedestrian railing is the sum of all the lengths of each pedestrian railing.

1. Defects are superficial and have no effect on the structural capacity of the railing. Connection is in place and function as needed.
2. Pedestrian Railing length where corrosion of steel has initiated and there may be areas of freckled rust. Cracking that has self-arrested or has been arrested with effective arrest holes, doubling plates, or similar may exist in the liner. Connections have loose fasteners or pack rust without distortion, but the connections are in place and functioning as intended. Distortion is present and has received a structural review and has been mitigated. Out-of-Plumb has minor tilt which is barely noticeable.
3. Pedestrian Railing length with structural defects that do not require a structural review or may require a structural review but does not require mitigation. Areas of corrosion may exist where section loss is evident, or pack rust is present. Cracks may exist and have not been arrested. Connections may have missing bolts, rivets, or fasteners; broken welds; or pack rust with distortion. Out-of-Plumb has excessive tilt that affects operations or causes near failure.
4. Pedestrian Railing condition warrants a structural review to determine the effect of strength or serviceability of the element or tunnel, OR a structural review has been completed and the defects impact strength and serviceability of the element or tunnel.

10171	Concrete Pedestrian Railing	Units – LF
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Record this element for all concrete pedestrian railing. This element defines those tunnel railings adjacent to a walkway.

The total quantity for pedestrian railing is the sum of all the lengths of each pedestrian railing.

1. Defects are superficial and have no effect on the structural capacity of the railing. Cracking may exist with widths less than 0.012 in. or spacing greater than 3.0 ft.
2. Pedestrian Railing length with delamination's, spalls 1 in. or less deep or 6 in. or less diameter, and/or patched areas that are sound. Areas of exposed rebar may be present but without measurable section loss. Efflorescence may include white surfaces without build-up or leaching without rust staining. Cracking may exist with widths 0.012 – 0.05 in. or spacing between 1.0 – 3.0 ft. Out-of-Plumb has minor tilt which is barely noticeable.
3. Pedestrian Railing length with structural defects that do not require a structural review. Spalls greater than 1.0 in. deep or greater than 6 in. diameter may exist, patched areas are unsound or showing distress. Areas of exposed rebar are present with measurable section loss. Areas of efflorescence may exist with heavy build-up and rust staining. Cracking may exist with widths greater than 0.05 in. or spacing less than 1.0 ft. Out-of-Plumb has excessive tilt that affects operations or causes near failure.
4. Pedestrian Railing condition warrants a structural review to determine the effect of strength or serviceability of the element or tunnel, OR a structural review has been completed and the defects impact strength and serviceability of the element or tunnel.

10179	Other Pedestrian Railing	Units - LF
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Record this element for all pedestrian railing composed of other materials. This element defines those tunnel railings adjacent to a walkway.

The total quantity for pedestrian railing is the sum of all the lengths of each pedestrian railing.

1. Pedestrian Railing is in good condition with no notable distress.
2. Pedestrian Railing is in fair condition with isolated breakdowns or deterioration. Out-of-Plumb has a minor tilt that is barely noticeable.
3. Pedestrian Railing is in poor condition with widespread deterioration or breakdowns without reducing load capacity. Out-of-Plumb has an excessive tilt that affects operations or induces near failure.
4. Pedestrian Railing condition warrants a structural review to determine the effect of strength or serviceability of the element or tunnel, OR a structural review has been completed and the defects impact strength and serviceability of the element or tunnel.

Tunnel Mechanical Systems

10200	Ventilation System	Units - EA
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Record this element for all tunnel lighting fixtures. This element describes the components that provide the supply of fresh air to the tunnel while removing stale air and contaminants. The ventilation system may include the following subcomponents: Fans - Fan Motors, Fan Controller, Airways, Sound Attenuators, Dampers, Damper Motor, Damper Controller, Air Quality Monitoring Equipment (CO), Control Panels and Conduit. For this element, a separate ventilation system is one system. Tunnels with twin bores may have separate ventilation systems and would be considered as two. Some tunnels may have a ventilation system at each portal that work independently and would also be considered as two.

The total quantity for ventilation system is the sum of all the ventilation systems.

1. The system is in good condition with no notable distress.
2. The system is in fair condition with isolated breakdowns or deterioration.
3. The system is in poor condition - widespread deterioration or breakdowns reducing operational capacity, without impacting the serviceability of the element or tunnel.
4. The condition warrants evaluation to determine the effect on serviceability of the element or tunnel or the evaluation has determined there is an impact on the serviceability of the element or tunnel.

10201	Fans	Units - EA
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Record this element for all fans. This element describes the components that produce a current of air which provides the supply of fresh air to the tunnel while removing stale air and contaminants. The fans may include the following subcomponents: Fan Motors, Fan Controller, etc.

The total quantity for fans is the sum of all the fans.

1. The fan is in good condition with no notable distress. Fan operates on all speeds and in all modes with no noticeable temperature rise.
2. The fan is in fair condition with isolated breakdowns or deterioration. Fan requires manual restart or manual control to operate on all speeds and in all modes. Drive(s) require some adjustment. More than normal play observed, and/or belt has minor wear/deterioration. Less than 40-degree Fahrenheit temperature rise from ambient temperatures during operation.
3. The fan is in poor condition with widespread deterioration or breakdowns without reducing load capacity. Fan operates on at least one speed or only operates in manual mode. Drive(s) require major adjustment. Severe play and/or belt/chain noise is observed, and/or belt has moderate wear/deterioration. Between 40-degree Fahrenheit and 80-degree Fahrenheit temperature rise from ambient temperatures during operation.
4. The fan condition warrants evaluation to determine the effect on serviceability of the element or tunnel or the evaluation has determined there is an impact on the serviceability of the element or tunnel. Fan will not operate on any speed and/or there is over an 80-degree Fahrenheit temperature rise for ambient temperatures during operation.

10300	Drainage and Pumping System	Units - EA
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Record this element for all drainage and pumping systems. This element includes storm drains, piping, pumps and water treatment equipment for the removal of water that may enter the tunnel from the portals, vent shafts, and cracks in the tunnel lining. Drainage at the tunnel facility also handles the drippings from vehicles traversing the tunnel and potential spills from trucks hauling liquid materials. The drainage and pumping system may include the following subcomponents: Pumps – Sump Pumps, Pump Motors, Pump Controller, Piping, Drains and Water Treatment Equipment. For this element, a separate drainage and pumping system is one system. Tunnels with twin bores may have separate draining and pumping systems and would be considered as two. Some tunnels may have a draining and pumping system at each portal that work independently and would also be considered as two.

The total quantity for drainage and pumping system is the sum of all the draining and pumping systems.

1. The system is in good condition with no notable distress.
2. The system is in fair condition with isolated breakdowns or deterioration.
3. The system is in poor condition – widespread deterioration or breakdowns reducing operational capacity, without impacting the serviceability of the element or tunnel.
4. The condition warrants evaluation to determine the effect on serviceability of the element or tunnel or the evaluation has determined there is an impact on the serviceability of the element or tunnel.

10301 Pumps **Units - EA**

Record this element for all pumps. This element includes the component that moves water that may enter the tunnel from the portals, vent shafts, and crack in the tunnel lining. The pumps may include the following subcomponents: Sump Pumps, Pump Motors, Pump Controller, etc.

The total quantity for pumps is the sum of all the pumps.

1. Pump operates at all speeds and in all modes. The shut-off valves operate freely and without binding. There is a fair amount of noise and vibration velocity has a value of 100 in/s or less. No oil leakage, leakage is observed at pump seal, or water leakage noted in immediate piping and valves in observed. Motor temperature is within expected limits.
2. Pump operates at all speeds and in all modes in a reduced capacity. The shut-off valves operate with some resistance and binding but do appear to fully open/seal. There is some slightly rough noise and vibration velocity between 100 and 300 in/s. There is limited exterior staining from oil seepage at seals and limited water seepage from seals with seals appearing wet. Motor temperature is slightly increased during motor operation.
3. Pump operates intermittently or haltingly. The shut-off valves are difficult or impossible to operate. There is a rough noise and vibration velocity exceeds 300 in/s. There is extensive exterior staining from oil seepage around seals and measurable water seepage around seals that can be quantified in drips per minute. Motor temperature is moderately above what is expected and/or hot spots of temperature exist.
4. Pump will not operate. There is pooling of oil on exterior surfaces of seals or significant reduction of interior lubricant level. There is a visible stream of water on exterior surfaces of seals or significant reduction of pump performance. Motor temperature is drastically increased and motor function is influenced.

10400	Emergency Generator System	Units - EA
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Record this element for all emergency generator systems. These elements are the mechanical components of an emergency generator and power system which consist of fuel delivery, fuel storage, an engine cooling and exhaust systems. The emergency generator provides a back-up power source in the event of utility service failure to the tunnel. The mechanical systems support the proper operation of the generator to provide back-up power. The emergency generator system may include the following subcomponents: Fuel Main Storage Tank, Fuel Day Tanks, Circulating Fuel Pumps, Fuel Tank Venting, Fuel Tank Sensors, Coolant Systems, Exhaust Manifold Insulation and Lagging, Exhaust Air Louver and Damper Actuator, Supply Air Louver and Damper Actuator, Generator, Generator Control Equipment, Control Panels and Conduit. For this element, a separate emergency generator system is one system. Tunnels with twin bores may have separate emergency generator systems and would be considered as two.

The total quantity for emergency generator is the sum of all the emergency generator systems.

1. The system is in good condition with no notable distress.
2. The system is in fair condition with isolated breakdowns or deterioration.
3. The system is in poor condition – widespread deterioration or breakdowns reducing operational capacity, without impacting the serviceability of the element or tunnel.
4. The condition warrants evaluation to determine the effect on serviceability of the element or tunnel or the evaluation has determined there is an impact on the serviceability of the element or tunnel.

10400	Emergency Generator System	Units - EA
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Record this element for all flood gates. These elements are the actual gates, seals, mechanical components, and power supply of a flood gate system. The flood gates are typically located at each portal for each bore. The flood gates are usually used when the tunnel roadway is closed and the bores are threatened with taking on water at the portals. For this element, a separate flood gate is one gate. Some tunnels may have a flood gate at each portal that work independently and would be considered as two.

The total quantity for flood gate is the sum of all the flood gates.

1. The system is in good condition with no notable distress.
2. The system is in fair condition with isolated breakdowns or deterioration.
3. The system is in poor condition – widespread deterioration or breakdowns reducing operational capacity, without impacting the serviceability of the element or tunnel.
4. The condition warrants evaluation to determine the effect on serviceability of the element or tunnel or the evaluation has determined there is an impact on the serviceability of the element or tunnel.

Tunnel Electrical Systems

10500	Electrical Distribution System	Units - EA
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Record this element for all electrical distribution systems. The electrical distribution system consists of the electrical equipment, wiring, conduit, and cable used for distributing electrical energy from the utility supply (service entrance) to the line terminals of utilization equipment. The electrical distribution system may include the following subcomponents: Switchgear, Unit Substations, Switchboard, Motor Control Centers, Starters, Transformers, Transfer Switches, Panelboards, Conduits and Raceways, and Electrical Outlets/Receptacles For this element, a separate electrical distribution system is one system. Tunnels with twin bores may have separate electrical distribution systems and would be considered as two.

The total quantity for electrical distribution system is the sum of all the electrical distribution systems.

1. The system is in good condition with no notable distress.
2. The system is in fair condition with isolated breakdowns or deterioration.
3. The system is in poor condition – widespread deterioration or breakdowns reducing operational capacity, without impacting the serviceability of the element or tunnel.
4. The condition warrants evaluation to determine the effect on serviceability of the element or tunnel or the evaluation has determined there is an impact on the serviceability of the element or tunnel.

10550	Emergency Distribution System	Units - EA
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Record this element for all emergency distribution systems. This system consists of the electrical equipment, wiring, conduit, and cable used for providing electrical power in case of utility service failure. Equipment included in this system consists of emergency generators and/or uninterruptible power supply (UPS) systems, transfer switches, and other equipment supplying emergency power. The emergency distribution system may include the following subcomponents: Uninterruptible Power Supply (UPS), batteries and battery charging equipment. For this element, a separate emergency distribution system is one system. Tunnels with twin bores may have separate emergency distribution systems and would be considered as two.

The total quantity for emergency distribution system is the sum of all the emergency distribution systems.

1. The system is in good condition with no notable distress.
2. The system is in fair condition with isolated breakdowns or deterioration.
3. The system is in poor condition – widespread deterioration or breakdowns reducing operational capacity, without impacting the serviceability of the element or tunnel.
4. The condition warrants evaluation to determine the effect on serviceability of the element or tunnel or the evaluation has determined there is an impact on the serviceability of the element or tunnel.

10600	Tunnel Lighting System	Units - EA
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Record this element for all tunnel lighting systems. These systems consist of the light fixtures, supports, bulb housings, lenses, light switches, junction boxes, wiring, conduit, cable, sensors, and controllers used to provide lighting for the tunnel. The tunnel lighting system may also include the following subcomponents: photo controls, and remote ballasts. For this element, a separate tunnel lighting system is one system. Tunnels with twin bores may have separate tunnel lighting systems and would be considered as two.

The total quantity for tunnel lighting system is the sum of all the tunnel lighting systems.

1. The system is in good condition with no notable distress.
2. The system is in fair condition with isolated breakdowns or deterioration.
3. The system is in poor condition – widespread deterioration or breakdowns reducing operational capacity, without impacting the serviceability of the element or tunnel.
4. The condition warrants evaluation to determine the effect on serviceability of the element or tunnel or the evaluation has determined there is an impact on the serviceability of the element or tunnel.

10601	Tunnel Lighting Fixtures	Units - EA
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Record this element for all tunnel lighting fixtures. This element includes the physical housing of the tunnel lights and their connections to the support but does not include the bulb. When a lighting fixture serves the dual purpose of general tunnel lighting and emergency tunnel lighting, it is only counted under the tunnel lighting fixture element. However, those fixtures will have an impact on both tunnel lighting system and emergency lighting system elements.

The total quantity for tunnel lighting fixture is the sum of all the tunnel lighting fixtures.

1. The system is in good condition with no notable distress. There are no deficient support conditions.
2. The component supports have loose anchorage or component housing connection hardware. There is freckled rust, and/or corrosion of the steel has initiated. The component housing or enclosure has a single crack.
3. The component supports have missing anchorage or component housing connection hardware which does not result in an unstable situation. There is section loss evident or pack rust is present but does not warrant structural review. The component housing or enclosure has multiple cracks.
4. The condition warrants a structural review to determine the effect on strength or serviceability of the element or tunnel, OR a structural review has been completed and the defects impact strength and serviceability of the element or tunnel. The component supports have failed anchorage or component connection hardware which results in an unstable situation. Holes are present in the component housing or enclosure.

10620	Emergency Lighting System	Units - EA
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Record this element for all emergency lighting systems. These systems consist of the light fixtures, supports, bulb housings, lenses, light switches, junction boxes, wiring, conduit, cable, sensors, and controllers used to provide emergency lighting for the facility. The emergency lighting system may also include the following subcomponents: exit signs, batteries; and support space sighting, and remote ballasts. For this element, a separate emergency lighting system is one system. Tunnels with twin bores may have separate emergency lighting systems and would be considered as two.

The total quantity for emergency lighting system is the sum of all the emergency lighting systems.

1. The system is in good condition with no notable distress.
2. The system is in fair condition with isolated breakdowns or deterioration.
3. The system is in poor condition – widespread deterioration or breakdowns reducing operational capacity, without impacting the serviceability of the element or tunnel.
4. The condition warrants evaluation to determine the effect on serviceability of the element or tunnel or the evaluation has determined there is an impact on the serviceability of the element or tunnel.

10621	Emergency Lighting Fixture	Units - EA
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Record this element for all emergency lighting fixtures. This element includes the physical housing of the emergency lights and their connections to the tunnel. Component supports include anchorage to the supporting member and connecting hardware for the component housing. When a lighting fixture serves the dual purpose of general tunnel lighting and emergency tunnel lighting, it is only counted under the tunnel lighting fixture element. However, those fixtures will have an impact on both tunnel lighting system and emergency lighting system elements.

The total quantity for emergency lighting fixture is the sum of all the emergency lighting fixtures.

1. The system is in good condition with no notable distress. There are no deficient support conditions.
2. The component supports have loose anchorage or component housing connection hardware. There is freckled rust, and/or corrosion of the steel has initiated. The component housing or enclosure has a single crack.
3. The component supports have missing anchorage or component housing connection hardware which does not result in an unstable situation. There is section loss evident or pack rust is present but does not warrant structural review. The component housing or enclosure has multiple cracks.
4. The condition warrants a structural review to determine the effect on strength or serviceability of the element or tunnel, OR a structural review has been completed and the defects impact strength and serviceability of the element or tunnel. The component supports have failed anchorage or component connection hardware which results in an unstable situation. Holes are present in the component housing or enclosure.

Fire/Life Safety/Signs/Security Systems

10650	Fire Detection System	Units - EA
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Record this element for all fire detection systems. These systems consist of control panels, initiating devices (heat and smoke detectors, pull-stations, etc.), notification appliances (strobes, horns, etc.), wiring, conduit, and cable used to detect a fire in the tunnel. The fire detection system may also include the following subcomponents: sensors, controls, and alarms. For this element, a separate fire detection system is one system. Tunnels with twin bores may have separate fire detection systems and would be considered as two.

The total quantity for fire detection system is the sum of all the fire detection systems.

1. The system is in good condition with no notable distress. All detection sensors are operational.
2. The system is in fair condition with isolated breakdowns or deterioration.
3. The system is in poor condition – widespread deterioration or breakdowns reducing operational capacity, without impacting the serviceability of the element or tunnel. Detection sensors are not operational in one zone.
4. The condition warrants evaluation to determine the effect on serviceability of the element or tunnel or the evaluation has determined there is an impact on the serviceability of the element or tunnel. Detection sensors are not operational in multiple zones.

10700	Fire Protection System	Units - EA
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Record this element for all fire protection systems. These systems consist of fire extinguishers, hose connections, storage tanks, fire hydrants, building sprinklers, pumping systems, piping, circulating pumps, and hose reels used as fire protection in the tunnel. The fire protection system may include the following subcomponents: main fire pump, pressure maintenance/jockey pump, dry pipe valve, valves and tamper switches, storage tanks, tunnel standpipe, pressure relief and air release valves, backflow prevention, hose stations, hose reels, building sprinklers, fire department connections and fire hydrants. For this element, a separate fire protection system is one system. Tunnels with twin bores may have separate fire protection systems and would be considered as two.

The total quantity for fire protection system is the sum of all the fire protection systems.

1. The system is in good condition with no notable distress.
2. The system is in fair condition with isolated breakdowns or deterioration.
3. The system is in poor condition – widespread deterioration or breakdowns reducing operational capacity, without impacting the serviceability of the element or tunnel.
4. The condition warrants evaluation to determine the effect on serviceability of the element or tunnel or the evaluation has determined there is an impact on the serviceability of the element or tunnel.

10750	Emergency Communication System	Units - EA
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Record this element for all emergency communication systems. The components of the emergency communication system include the communication device itself (i.e., intercom, radios, cellphone), receivers, wiring, exchange devices, etc. The emergency communications system may also include the following subcomponents: signs, controllers, speakers and audio input equipment. For this element, a separate emergency communication system is one system. Tunnels with twin bores may have separate emergency communication systems and would be considered as two.

The total quantity for emergency communication system is the sum of all the emergency communication systems.

1. The system is in good condition with no notable distress.
2. The system is in fair condition with isolated breakdowns or deterioration.
3. The system is in poor condition – widespread deterioration or breakdowns reducing operational capacity, without impacting the serviceability of the element or tunnel.
4. The condition warrants evaluation to determine the effect on serviceability of the element or tunnel or the evaluation has determined there is an impact on the serviceability of the element or tunnel.

10800	Tunnel Operations and Security System	Units - EA
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Record this element for all tunnel operations and security systems. These systems consist of the communication equipment (CCTV cameras, telephones, radios, etc.) used to provide communication within and from the tunnel. The tunnel operations and security system may also include the following subcomponents: closed-circuit camera system, cell phone antennas, door access, controller and radio. For this element, a separate tunnel operation and security system is one system. Tunnels with twin bores may have separate tunnel operations and security systems and would be considered as two.

The total quantity for tunnel operations and security system is the sum of all the tunnel operations and security systems.

1. The system is in good condition with no notable distress.
2. The system is in fair condition with isolated breakdowns or deterioration.
3. The system is in poor condition – widespread deterioration or breakdowns reducing operational capacity, without impacting the serviceability of the element or tunnel.
4. The condition warrants evaluation to determine the effect on serviceability of the element or tunnel or the evaluation has determined there is an impact on the serviceability of the element or tunnel.

10850	Traffic Sign	Units - EA
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Record this element for all traffic signs. These elements consist of the traffic sign and supports. Signs for pedestrians, variable message signs and lane signals are not covered under this element. The MUTCD Chapter 2 contains the requirements for the shape and wording of regulatory, warning and guide signs on a highway or road. It also contains requirements for maintaining minimum retro reflectivity of signs.

The total quantity for traffic signs is the sum of all the traffic signs.

1. The system is in good condition with no notable distress. There are no deficient support conditions.
2. The component supports have loose anchorage or component housing connection hardware.
3. The component supports have missing anchorage or component housing connection hardware which does not result in an unstable situation.
4. The component supports have failed anchorage or component connection hardware which results in an unstable situation.

10870	Egress Sign	Units - EA
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Record this element for all egress signs. This element consists of egress signs and their supports that are not related to the emergency lighting system. The MUTCD Chapter 2 contains the requirements for the shape and wording of regulatory, warning and guide signs on a highway or road. It also contains requirements for maintaining minimum retro reflectivity of signs.

The total quantity for egress sign is the sum of all the egress signs.

1. There are no deficient support conditions.
2. The component supports have loose anchorage or component housing connection hardware.
3. The component supports have missing anchorage or component housing connection hardware which does not result in an unstable situation.
4. The component supports have failed anchorage or component connection hardware which results in an unstable situation.

10890	Variable Message Board	Units - EA
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Record this element for all variable message boards. This element consists of the variable message board, supports and associated electrical connections. The MUTCD Chapter 2 contains the requirements for the shape and wording of regulatory, warning and guide signs on a highway or road. It also contains requirements for maintaining minimum retro reflectivity of signs.

The total quantity for variable message board is the sum of all the variable message boards.

1. The sign is functional and operates when tested. There are no deficient support conditions.
2. The sign operates with minor decrease in light output, flicker, or reduced display area. The component supports have loose anchorage or component housing connection hardware.
3. The sign operates with significant decrease in light output, flicker, and/or reduced display area. The component supports have missing anchorage or component housing connection hardware which does not result in an unstable situation.
4. The sign is not operational. The component supports have failed anchorage or component connection hardware which results in an unstable situation.

10910	Lane Signal	Units - EA
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Record this element for all lane signals. The components of the tunnel lane signal system include the lane signals themselves, their supports and the control system.

The lane signals may include the following subcomponents: signals/fixtures, control station, control cabinets and conduit. The MUTCD Chapter 2 contains the requirements for the shape and wording of regulatory, warning and guide signs on a highway or road. It also contains requirements for maintaining minimum retro reflectivity of signs.

The total quantity for lane signal is the sum of all the lane signals.

1. The sign is functional and operates when tested. There are no deficient support conditions.
2. The sign operates with minor decrease in light output, flicker, or reduced display area. The component supports have loose anchorage or component housing connection hardware.
3. The sign operates with significant decrease in light output, flicker, and/or reduced display area. The component supports have missing anchorage or component housing connection hardware which does not result in an unstable situation.
4. The sign is not operational. The component supports have failed anchorage or component connection hardware which results in an unstable situation.

10911	Lane Signal Fixture	Units - EA
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Record this element for all lane signal fixtures. The components of the tunnel lane signal fixtures include the fixtures themselves, the supports and the wiring. The lane signal fixtures may also include the following subcomponents: fixtures and conduits. The MUTCD Chapter 2 contains the requirements for the shape and wording of regulatory, warning and guide signs on a highway or road. It also contains requirements for maintaining minimum retro reflectivity of signs.

The total quantity for lane signal fixture is the sum of all the lane signal fixtures.

1. The system is in good condition with no notable distress. There are no deficient support conditions.
2. The component supports have loose anchorage or component housing connection hardware. There is freckled rust, and/or corrosion of the steel has initiated. The component housing or enclosure has a single crack.
3. The component supports have missing anchorage or component housing connection hardware which does not result in an unstable situation. There is section loss evident or pack rust is present but does not warrant structural review. The component housing or enclosure has multiple cracks.
4. The condition warrants a structural review to determine the effect on strength or serviceability of the element or tunnel, OR a structural review has been completed and the defects impact strength and serviceability of the element or tunnel. The component supports have failed anchorage or component connection hardware which results in an unstable situation. Holes are present in the component housing or enclosure.

Protective Systems

10950	Steel Corrosion Protective Coating	Units – SF
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Record this element for all steel corrosion protective coating used in the tunnel. The element is for steel elements that have a protective coating system such as paint, galvanization, or other topcoat steel corrosion inhibitor. Effectiveness is an evaluation made by the inspector to classify the degree to which the protection system is functioning to protect the steel beneath. Protective coatings only apply to those elements listed under the structural and civil sections.

The total quantity for protective coatings is the product of the length and width of the entire exposed surface of the element.

1. Coating is fully effective. Oxide film degradation color is yellow-orange or light brown for early development, chocolate-brown to purple-brown for fully developed. Texture is tightly adhered, capable of withstanding hammering or vigorous wire brushing.
2. Coating surface is dulling and only substantially effective. The texture is granular and the finishing coat is peel, bubbling, and/or cracking.
3. The coating has a loss of pigment and has limited effectiveness. The finishing and primer coats have peeling, bubbling, and/or cracking. The texture adherence has small flakes that are less than ½ inch in diameter.
4. The coating has an exposure of bare metal and has failed with no protection of the underlying metal. The oxide film degradation color is dark black. The texture adherence has large flakes that are ½ inch in diameter or greater or has laminar sheets or nodules.

10951	Concrete Corrosion Protective Coating	Units – SF
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Record this element for all concrete corrosion protective coating used in the tunnel. This element is for concrete elements that have a protective coating applied to them. These coatings include silane/siloxane water proofers, crack sealers such as High Molecular Weight Methacrylate (HMWM), or any topcoat barrier that protects concrete from deterioration and reinforcing steel from corrosion. Effectiveness is an evaluation made by the inspector to classify the degree to which the protection system is functioning. Protective coatings only apply to those elements listed under the structural and civil sections.

The total quantity for protective coatings is the product of the length and width of the entire exposed surface of the element.

1. Underlying concrete is not exposed and coating is fully effective.
2. Coating is substantially effective. Underlying concrete is not exposed, coating is showing signs of wear from UV exposure, and/or friction course is missing.
3. The coating has limited effectiveness. The underlying concrete is not exposed, but thickness of coating is reduced.
4. The coating has failed with no protection. The underlying concrete is exposed.

10952	Fire Protective Coating	Units - SF
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Record this element for all fire protective coatings used in the tunnel. This element is the coating applied on the tunnel elements to protect these elements from fire.

The total quantity for protective coatings is the product of the length and width of the entire exposed surface of the element.

1. Fire protective coating is fully effective and will function as designed in a fire.
2. Fire protective coating area is substantially effective.
3. Fire protective coating area that has limited effectiveness.
4. Fire protective coating area that has failed and is no longer protecting the underlying material.

10955	Reflective Tunnel Tile	Units - SF
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This element identifies tunnel tile attached to a tunnel liner whether it is reflective or not. The total quantity is the area of tile visible for inspection.

1. Tile is bonded with no cracks, chips, or blemishes. Tile may be dirty but reflectivity is enhanced during regular tunnel washing operations.
2. Tile area that has been repaired.
3. Tile area that is bonded, but cracked and may have efflorescence or small amounts of section loss. Tile may be blemished from impact or other causes resulting in major loss of reflectivity.
4. Tile area with delamination's based on soundings, is completely missing, or has major section loss warranting replacement.

Appendix 9-B Vacant

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Appendix 9-C WSDOT/NTI Tunnel Inventory Codes

WSBIS	NTI Item ID	NTI Inventory Item Name	Comments
1001	I.1	Tunnel Number	
1132	I.2	Tunnel Name	
n/a	I.3	State Code	autogenerated for the NTI submittal
1021	I.4	County Code	
1276	I.5	Place Code	
1274	I.6	Highway Agency District	
1435	I.7	Route Number	
1436	I.8	Route Direction	
1433	I.9	Route Type	
1256	I.10	Facility Carried	
1467	I.11	LRS Route ID	
1469	I.12	LRS Mile Point	
1188	I.13	Tunnel Portal's Latitude	
1196	I.14	Tunnel Portal's Longitude	
n/a	I.15	Border Tunnel State or Country Code	Washington State has no border tunnels, autogenerated for NTI submittal
n/a	I.16	Border Tunnel Financial Responsibility	Washington State has no border tunnels, autogenerated for NTI submittal
n/a	I.17	Border Tunnel Number	Washington State has no border tunnels, autogenerated for NTI submittal
n/a	I.18	Border Tunnel Inspection Responsibility	Washington State has no border tunnels, autogenerated for NTI submittal
1332	A.1	Year Built	
1336	A.2	Year Rehabilitated	
1354	A.3	Total Number of Lanes	
1445	A.4	Average Daily Traffic	
1451	A.5	Average Daily Truck Traffic	
1453	A.6	Year of Average Daily Traffic	
1413	A.7	Detour Length	
1543	A.8	Service in Tunnel	
1019	C.1	Owner	
1286	C.2	Operator	
1490	C.3	Direction of Traffic	
1285	C.4	Toll	
1483	C.5	NHS Designation	
1485	C.6	STRAHNET Designation	
1487	C.7	Functional Classification	
1022	C.8	Urban Code	
1349	G.1	Tunnel Length	
1401	G.2	Minimum Vertical Clearance over Tunnel Roadway	
1356	G.3	Roadway Width, Curb-to-Curb	
1364	G.4	Left Sidewalk Width	
1367	G.5	Right Sidewalk Width	

WSBIS	NTI Item ID	NTI Inventory Item Name	Comments
1992	D.1	Routine Inspection Target Date	
n/a	D.2	Actual Routine Inspection Date	Inspection dates for routine report type will be reported to the NTI.
n/a	D.3	Routine Inspection Interval	Inspection frequencies for routine report type will be reported to the NTI.
n/a	D.4	In-Depth Inspection	Structures with this report type will be flagged as such in the NTI submittal.
n/a	D.5	Damage Inspection	Structures with this report type will be flagged as such in the NTI submittal.
n/a	D.6	Special Inspection	Structures with this report type will be flagged as such in the NTI submittal.
1554	L.1	Load Rating Method	
1556	L.2	Inventory Load Rating Factor	
1553	L.3	Operating Load Rating Factor	
1293	L.4	Tunnel Load Posting Status	
1560	L.5	Posting Load - Gross	
1561	L.6	Posting Load - Axle	
1562	L.7	Posting Load - Type 3	
1563	L.8	Posting Load - Type 3S2	
1564	L.9	Posting Load - Type 3-3	
1402	L.10	Height Restriction	
1408	L.11	Hazardous Material Restriction	
1409	L.12	Other Restrictions	
n/a	N.1	Under Navigable Waterway	Washington state has no tunnels under waterways, autogenerated for the NTI submittal.
n/a	N.2	Navigable Waterway Clearance	Washington state has no tunnels under waterways, autogenerated for the NTI submittal.
n/a	N.3	Tunnel or Portal Island Protection from Navigation	Washington state has no tunnels under waterways, autogenerated for the NTI submittal.
1510	S.1	Number of Bores	
1511	S.2	Tunnel Shape	
1512	S.3	Portal Shapes	
1513	S.4	Ground Conditions	
1514	S.5	Complex	